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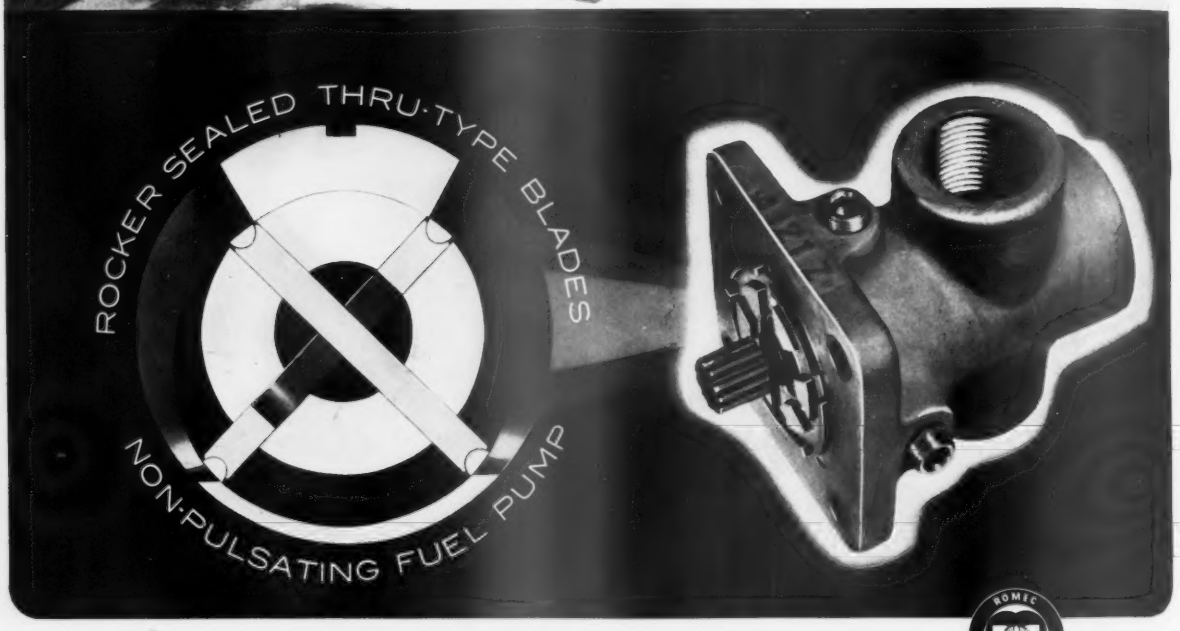
AERONAUTICAL ENGINEERING REVIEW

OCTOBER 1942

THE PUMP THAT *Improves* WITH USE!



The cardinal principle on which ROMEC pumps operate is the off-set rotor revolving two rocker-sealed thru-type blades within a developed bore; the one-piece blades moving back and forth through accurately machined rotor slots.

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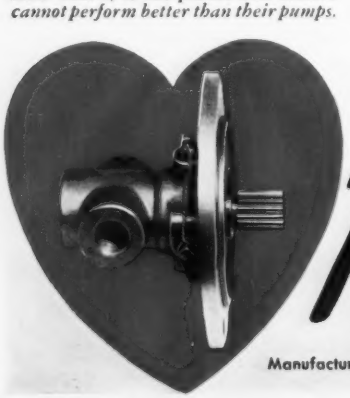

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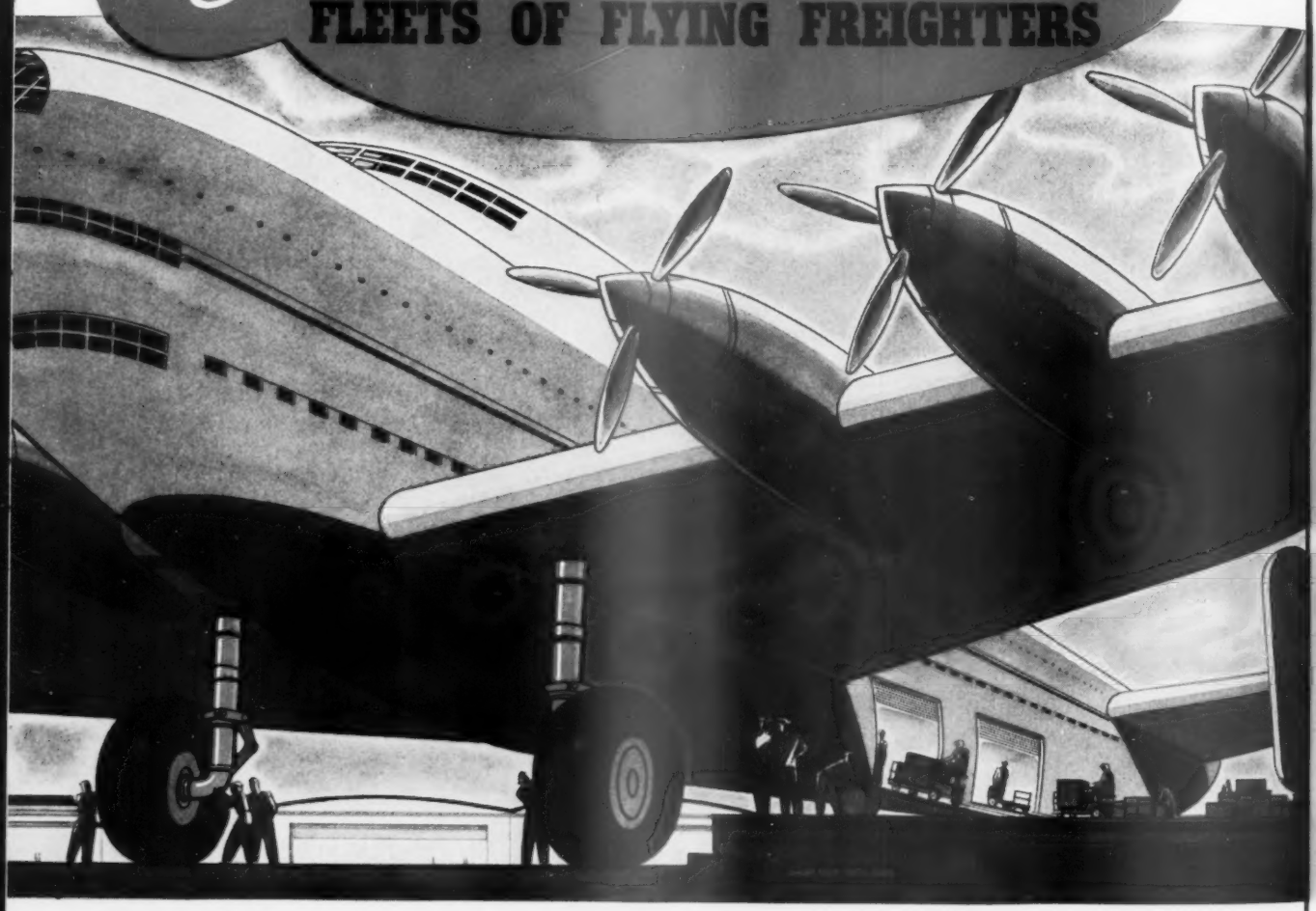
Here in America, soon
FLEETS OF FLYING FREIGHTERS



★ From the ashes of war's destruction shall rise a greater mode of transportation — the "*merchant aerine.*" Already the logistics of global warfare are requiring aerial armadas of military cargo-planes. When peace returns, they will have proved that flying freighters not only have greater speed and mobility, but also carry cargo at a low cost per ton-mile.

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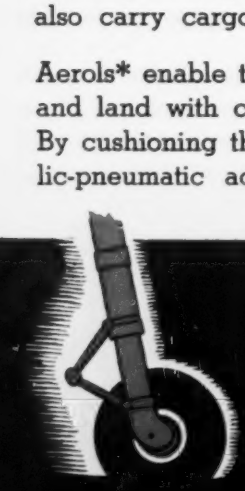


AEROLS*

*THE SHOCK ABSORBING UNITS ON AN AIRPLANE'S LANDING GEAR; THE NAME IS DERIVED FROM THE WORDS "AIR" AND "OIL" — THE FLUIDS USED TO DISSIPATE THE LANDING SHOCKS

Economic Effects of Airport Size and Airway Deficiencies

A. E. BLOMQUIST,* *Eastern Air Lines, Inc.*

Introduction

There are three important problems facing the air transport industry which should be solved as quickly as possible. These are:

(1) The problem of instrument landing systems. This problem has gone unanswered since 1932 and has been, in the past, the major stumbling block to dependable air transportation.

(2) The problem of congested air space and landing areas at large centers is relatively new, but it, too, threatens to disrupt air-line attempts to render fine service. Reduction of stacking must be considered.

(3) The thousands of landings and take-offs that are being made, and the increase in volume that can be expected make it advisable to consider the redesign of transport airports from the standpoint of increasing ground efficiency.

Instrument Landing Systems

Since December 1, 1940, 36 persons have lost their lives and 43 have been injured in five accidents on or near airports. In each case, the captain of the plane was making an instrument approach. A summation of the official records shows that in each accident the ceiling and visibility existing at the time were at or above the minimums. In several of the accidents the captain broke out of the ceiling and circled the field.

The testimony also reveals that in performing the normal approach procedure, each captain had to make a series of decisions under critical conditions and at a time when his full attention should have been on the control of his plane. This contention is borne out by the general instructions for "Landing-Down-Through" procedures that are found in the operations manuals of every air line and which are as follows:

Landing-Down-Through Procedure

Initial Approach

This is the first approach to the range station for the purpose of definitely locating the exact position of the plane relative to the ground. Approximate normal cruising speed should be maintained throughout this approach. The minimum altitude specified for the initial approach is an altitude sufficient to clear all obstructions to flight for a distance of 25 miles either side of the airway between the last definite fix and the radio range in question and within a 25-mile radius of the station. Upon crossing radio station on the initial approach, the ground station will be immediately notified. Where fan markers or other suitable means of definitely locating the position of the plane are installed and operating within 25 miles of airport on the leg of the radio range used for the initial approach, and where this leg is also used for final approach, the plane may descend to final approach altitude after crossing fan marker.

Return for Final Approach

Upon passing and checking the range station on the initial approach, the flight will proceed to and out the final approach leg, following a procedure that will keep the plane as near as practical on an "on-course" of one of the radio range courses at all times. Landing gear will be lowered and the propeller speed setting changed for a given r.p.m. Flight speed is reduced and altitude is lost to 200 ft. above that specified for crossing the station on the final approach. Proceed out leg 3 to 5 min. (depending on wind) before making procedure turn for final approach.

Procedure Turn

This is the turn off the leg of the range for the purpose of reversing direction on the leg and will be made as follows: The turn will be started by changing direction 45 deg. to *R* (unless otherwise specified for range or leg), proceeding in this new direction for 25 to 45 sec. (depending on whether the plane is proceeding down-wind or up-wind), then making a 180-deg. turn away from range station (opposite to initial 45-deg. turn), permitting the plane to intercept the leg at a 45-deg. angle.

Final Approach

Upon completion of the procedure turn the flight will proceed toward the station on the final approach maintaining an indicated air speed of from 110 to 120 m.p.h. on DC-3 and 100 to 110 m.p.h. on DC-2, passing over the range station at the minimum altitude specified.

Descent to Field

Immediately upon reaching the cone of silence, the descent will be started, the Captain using the first 3 to 10 sec. after reaching cone to check his position during descent. If after the 10-sec. interval the Captain is not satisfied that he is in the desired position, he should pull up and repeat his approach according to particular instructions for that field. If he is satisfied with his position, he should continue the descent, descending to the minimum allowed for the field in question and never below this minimum unless the ground is clearly visible by or before this altitude has been reached.

Discussion

There is an average of 40,000 of this type of instrument approach made each year by all transport planes. In every case there are at least a 300-ft. ceiling and 1 mile visibility.

It is evident from the accident records and the foregoing discussion of procedure that the present system offers no positive control and places too much responsibility on the pilot. This system of instrument approach cannot be basically improved, and there has been little change in the procedure in the last six years. It would seem, even to the least critical, that the air transport industry should have some positive system of guiding airplanes to safe landings during inclement weather.

The air lines of the United States have, since January, 1936, lost at least $11,000,000 in passenger revenue. This is not money that might have been received but is cash that was handed back to passengers when flights were canceled short of their destinations because of weather. This represents not more than 20 per cent of the indirect costs of the hundreds of canceled flights and must be small indeed when compared with the millions lost by "stacking," holding at way stations for a few hours and overnight, and other forms of traffic delays.

Practically 85 per cent of all schedules operated by Eastern Air Lines are completed with little or no interference from meteorologic phenomena such as poor

Presented at the Air Transport Session, Tenth Annual Meeting, I.Ae.S., New York, January 30, 1942.

* Airport Engineer.

visibility, low ceilings, severe storms, icing conditions, etc. Of the remaining 15 per cent canceled due to inclement weather, only 3 to 5 per cent have to be canceled or delayed because of severe icing conditions or zero-zero limits at the airport. The remaining schedules are disturbed by ceilings at or below the minimums established by the Civil Aeronautics Authority. These minimums of from 400 to 1,000 ft. are often reached by low prevailing ceiling conditions; however, there is rarely a condition in which there is not some sort of flyable ceiling or visibility.

The cancellations, caused in the main part by conditions of ceiling and visibility below the minimums set by the Civil Aeronautics Authority, have caused Eastern Air Lines to cancel 1,299,834 miles of scheduled operation in 1939 and 1940 and to return to canceled passengers approximately $720,369 in that two-year period. A comparison of these figures with total miles flown by this line and by the industry in this two-year period, and in the period 1936 through 1940, gives some indication of the revenue returned to passengers.

Revenue Miles	1939	1940
Eastern Air Lines	11,000,167	15,779,240
Industry	82,554,239	108,800,436

The 1,299,834 miles of scheduled operation canceled in 1939 and 1940 equals 4.86 per cent of the total miles flown. Applying this to the domestic air lines: 4.86 per cent of 191,354,675 equals 9,300,000 miles canceled by all lines and 9,300,000 times 55.65 cents equals $5,170,000 (where 55.65 cents is the revenue per mile on a 50 per cent load factor for passengers only). This is based on DC-3 equipment and does not allow for mileage flown by smaller equipment. Also, no account is taken of mail or express revenue loss.

Similarly, for the 1936–1940 period:

Miles Flown	1936–1940
Eastern Air Lines	49,222,278
Industry	390,872,235

Again, 4.86 per cent of 49,222,278 equals 2,390,000 miles canceled and 2,390,000 times 55.65 cents equals $1,330,000 revenue paid back to passengers by Eastern Air Lines; 4.86 per cent of 390,872,235 equals 19,000,000 miles canceled and 19,000,000 times 55.65 cents equals $10,550,000 revenue paid back to passengers by all lines.

These figures are only an approximation because of the number of unknowns involved. Even if they are approximate they must be on the conservative side when consideration is given to the multitude of direct and indirect costs involved in flight cancellations.

Indirect Costs of Cancellations

A majority of all flights canceled cause the various air lines to spend sums of money that probably exceed the revenue returned to passengers. There are costs directly connected with canceled and "held" flights that are readily listed and, simply by listing, carry sufficient strength to indicate to experienced air-line personnel the losses involved.

(1) Cab fares for transporting canceled passengers to the railroad or bus terminals.
(2) Cab fares for transporting passengers to and from hotels when scheduled flights are held at intermediate points for any length of time.
(3) Meals for canceled and held passengers.
(4) Hotel bills for held passengers.
(5) Expenses of flight crews of canceled and delayed flights.
(6) Expenses of field and traffic personnel in handling such flights.

Additional costs are involved in: (1) Unbalanced equipment location and the necessary ferry flights, with the resulting direct flying costs; (2) other flights canceled because of lack of equipment with a resultant loss of revenue; (3) added accounting costs in handling refunds and other charges mentioned above.

Most of the costs listed above cannot be considered as direct transportation charges. The program of delayed passenger handling which these costs represent has been accepted by the industry as a necessity of public relations and courtesy to passengers until such time as air transportation can be placed upon a thoroughly dependable basis.

The answer to the existing conditions is the immediate installation of some reasonable instrument landing system at most air-line airports and the gradual reduction of Civil Aeronautics Administration ceiling and visibility minimums as flight crews become proficient in the use of the system and the system itself is brought toward perfection.

Landing Systems Available

The science of scheduled operation has been vastly improved, except with regard to instrument landings. As long ago as 1932 several systems were proposed and demonstrated. Since that time there have been a half a dozen systems, any one of which might have been developed to a reasonable point of operating stability.

In 1935 and 1936 United Air Lines made well over 1,000 landings at the Oakland, California, Airport by using the Bendix Landing System. All of these landings were under the hood. Numerous tests and landings were run at Newark Airport on this system in 1937 and 1938. There were over 100 landings made while under the hood. The A. T. & T.-Lorenz System was tested over a long period of time at Indianapolis.

The Air Track System was tested at Pittsburgh by Pennsylvania Central Airlines. The Army or Hegenberger System was developed in 1936 and has been tested and used by the Army innumerable times since that date.

Perhaps the most important evidence is the use of the Lorenz System at Europe's leading airports. This system was put in service in 1934 and used from that date on.

There is no more graphic manner in which to illustrate the success of this system than to quote from a letter received from a K. L. M. operations executive who used the system consistently in 1935 and 1936. He writes:

"....However, from 1935 until the winter of 1936 when I came to this country, I made a great many flights, mostly from England to Holland and back, which involved the use of the Lorenz System, with quite a few landings through a thick fog at the Amsterdam Airport, Schipol.....

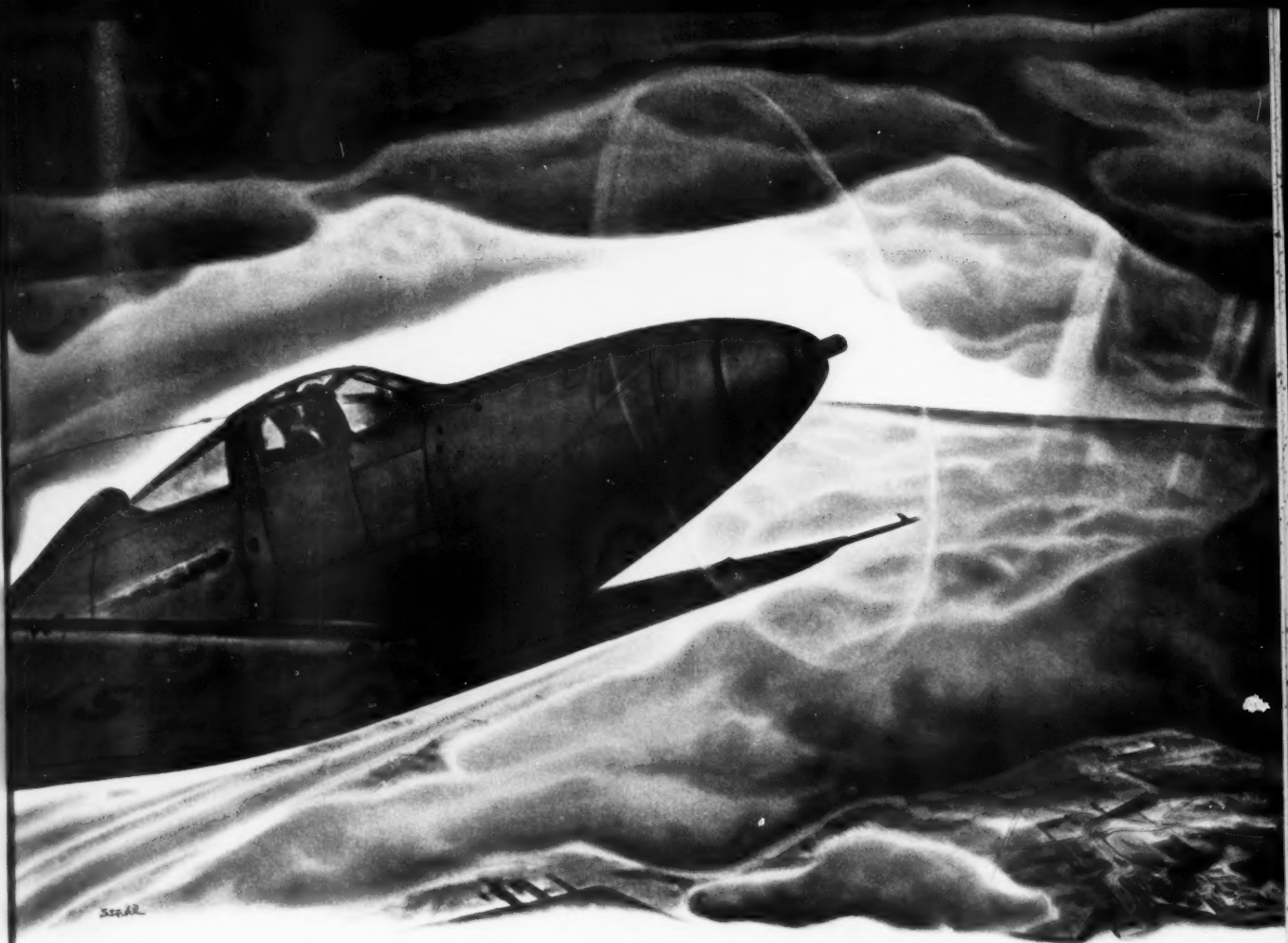
"....I made several landings with it at Amsterdam under fog conditions. Once, a ground fog about 100 ft. thick covered the airport, situated in a hollow below sea level, and covered the countryside as well, with the exception of the Stadium Tower. Our approach was normal, the course from Croydon being dead on the beam. I recall that we passed over the tower at 90 meters, simultaneously getting the beacon indication. Descending according to the indicator needles, we passed over the boundary marker at perhaps 10 meters and flew the DC-2 into the field without a jar and without having seen the field for the last mile or so."

The letter discussed some of the variances of European flight operations with our own but its contents most certainly indicate the success of some form of instrument landing system in daily schedule flight in Europe.

Airway Congestion

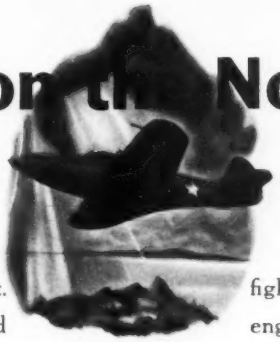
The problem of stacking around congested terminals has grown to alarming proportions in the last three years. This operating condition has become prevalent during weather producing relatively low ceilings and poor visibility.

The condition is common and those familiar with air-line operation will agree that the extracurricular costs involved are at least equal to those outlined in the first part of this paper. When planes are held in the air the delay produces (1) added flying time



Army Airacobra on a Fighting Front

HE'S BETTING *PLENTY* "on the Nose"



Sent "upstairs" to destroy an enemy attack, this flyer is placing his bets "on the nose" of his Army Airacobra.

For firing through the nose of his sleek and speedy fighter is a mighty cannon. A single shot, struck home, will blast the biggest bomber from the sky.

When plans were laid to build this "flying cannon" no gun so large had yet been mounted in a single-engine plane. And Bell Aircraft, too, did its betting "on the nose." We set a cannon out in front then built a fighter plane around it. It was a new and untried theory that called for pioneering skill and engineering genius.

Theorists said it wouldn't work—scoffed at the thought—while a staff of able aircraft engineers, assisted by our Army Air Force, set out to do the job.

Our answer is the Airacobra—the only single-engine fighter of its kind. With engine "aft" the pilot sits behind his cannon, as though he rode the breech, so deadly accurate is his aim. With all at stake he's betting plenty "on the nose." © Bell Aircraft Corporation, Buffalo, New York.

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1938 • The Hawk 75 . . . a monoplane fighter-bomber, incorporating heavier defense armament, increased maneuverability and carried a greater bomb load.

1940 • Curtiss P-40 Tomahawk . . . equipped the R.A.F. in the middle East and the American Volunteer Group in China, Java and Burma

on equipment, (2) added flying time for crew, (3) added man-hours necessary to handle delayed schedules at the terminal, to say nothing of the mental effect on the passenger. The present system of holding at intermediate points adds even more to the cost of the delay.

Inbound Schedule Delay

The New York terminal is one of the best examples of stacking. Because of the number of planes scheduled into La Guardia Airport, any bad weather will cause stacking and, if the period of low ceilings lasts more than 12 hours, scheduled operation is thoroughly disrupted.

The seriousness of this problem is exemplified in the following recent incidents: On October 3, 1941, 30 schedules inbound to La Guardia Airport were canceled at Philadelphia and 450 passengers were trained to New York. On October 7, 55 planes were canceled at Philadelphia and 825 passengers were trained to New York.

Eastern Air Lines, for instance, had, from May 16 through May 31, 1940, 45 schedules delayed in the air an average of 1 hour, and 47 schedules were canceled at Philadelphia because of traffic conditions. From December 2 through December 5, 1941, schedules were delayed on the ground or in the air anywhere from 5 min. to 3 hours, and 130 schedules were canceled. Some of these schedules were canceled because of ceilings below the minimums but a majority of the cancellations were due to traffic conditions.

The conditions of delayed operation outlined are prevalent at points now under the supervision of Air Traffic Control and, when ceilings go below 1,000 ft. at these terminals, inbound and outbound schedules are invariably delayed.

Departing Schedule Delay

Stacking seriously affects the routine departing schedules. When the weather at any controlled terminal produces ceilings and visibilities at or near the minimums set by the C.A.A., necessitating instrument approach procedures, the average time to complete a landing goes from 1 to 10 min., thereby reducing the capacity of the field from 60 planes an hour to six. This reduced capacity immediately affects the number of take-offs that can be made.

Under such conditions it is not uncommon to have outbound schedules at the large terminals delayed as much as 1 to 2 hours. The uncertainty of exact time of take-off results in passengers being held in planes at the ramp or at the runway end and creates an extremely unfavorable reaction.

The inherent dangers in the present methods of instrument operation in congested areas and the extremely high costs due to the lack of proper flight and landing aids are obvious. The remedies for these problems are certainly within reason.

Systems Needed

The ten instrument landing systems now "on order" will not answer the pressing need for safe, dependable service. Only 30 of these systems are needed to allow a majority of our air lines to carry out immediate system-wide training and the few remaining lines to carry out a limited training program.

By spotting the systems at suitable points to enable instrument landings every 300 miles, ample facilities would be provided for each air line to carry out routine training on each flight and thereby indoctrinate the greatest number of flight personnel in the shortest possible time. This plan would also assure complete protection to every air line in the country against sudden adverse changes in weather at periods of low ceilings by providing an instrument-landing system within reasonable range of all flights. This factor alone would be worth the cost of these 30 systems.

As the training programs progressed it would be possible to lower the minimums at properly equipped ports until the condition of zero-zero was finally achieved. The widespread use to which these first 30 systems would be subjected would soon reveal the remaining defects and would consequently permit more rapid development of perfected equipment. Even a limited use of the instrument-landing systems at congested terminals would relieve to a degree the stacking problem.

Discussion

At Le Bourget in 1937, Air France and other lines using the field found it possible to make instrument landings at the rate of one every 5 min. in zero-zero conditions. If an equal average could be reached at our congested terminals, it would mean more than double the present number of landings now made under instrument conditions. The effect of such a move is progressive in that the number of planes in and out is materially increased; the holding at intermediate points and in the air is reduced, and there would be many less cancellations because of traffic conditions.

The installation of instrument-landing systems will not alleviate the present congestion at the larger terminals. Even with dual runways it does not appear to be possible to execute landings and take-offs under instrument conditions at more than one take-off every 2 min. and one landing every 4 min. This hourly total of 30 planes off and 15 on will not accommodate present normal scheduling at ports such as are found at New York and Chicago. The answer does not lie in a single terminal for these large centers. There must be multiple terminals.

Multiple Terminals

The New York area is typical of the congestion that exists and which is certain to be much worse. La Guardia Airport has approximately 260 departures and arrivals in every 24-hour period, and Newark Airport has 94. A majority of these schedules are bunched in the three peak travel periods of the day. These peaks occur between 7:30 a.m. and 10:00 a.m., 3:00 p.m. and 6:00 p.m., 8:00 p.m. and 10:30 p.m. There are, of course, times during the day when there are no arrivals or departures, but, unfortunately, the peaks set the capacity of the field inasmuch as they are the popular travel hours.

Only by dividing the load among several airports can the pressure on La Guardia be released and some provision made for the future expansion of passenger and cargo service in and out of New York.

La Guardia, Floyd Bennett, and Newark airports are situated at the points of an equilateral triangle whose sides are 12 miles in length. Under the present controlling factor of instrument approach procedures, these three ports could handle 18 arrivals an hour. With dual runways, rearrangement of radio ranges and instrument-landing systems, a total of 45 arrivals and 90 departures per hour could be handled at these ports.

Express highways would play an important part in the proper functioning of a three-port system. By extending the present highway plan of the Greater New York Area it would be possible to schedule 30-min. connections between arriving and departing schedules at any combination of the three ports.

This system of multiple ports in the New York Area, or a similar system at any congested terminal, would immediately relieve all congestion in the immediate vicinity of the terminals and would consequently do away with the necessity for holding or canceling at intermediate points. It would simplify the operating problems of all the air lines serving the area by permitting each to concentrate its facilities at one of the three fields and maintain only a minimum staff at the other ports.

There are many devices now being used by our military services and under development in our laboratories which

will make our present systems of airway aids and instrument-landing systems obsolete when these aids are adapted to commercial use. No matter what changes are forthcoming, the immediate need is pressing to relieve stacking and congestion at large terminals and to provide instrument landing systems at a majority of the fields served by scheduled air transport.

Redesign of Transport Field to Increase Efficiency

The air liners of this country make over 500,000 landings and take-offs each year. The length of runways, position of taxiways, approaches and other factors of design cause excessive wear and gear on flying equipment that adds materially to the maintenance and overhaul costs.

A majority of the transport airports have an average runway length of 3,800 ft. and a width of 150 ft. In designing the taxiways, little consideration has been given generally to the position with respect to the runway length or the maneuvering of large planes upon the ground. As a result, when a transport plane lands, it invariably rolls past the turnoff point on the landing runway or must be sharply braked to slow the plane in time for the turnoff.

When a plane overrolls a taxiway, the pilot must then come to a stop and, by using alternate applications of power on his two engines and severe braking, turn the plane through 180 deg. The 150-ft. wide runway necessitates a sharp turn with the consequent torque action on the rubber of the inboard wheel.

The average taxiway or runway intersection has rather short radii of turns and the taxiways are rarely over 100 ft. in width. These conditions cause a pilot to bring his ship almost to a stop before he can negotiate the turn off the runway and a series of irregular applications of single-engine power to negotitate the relatively narrow taxiway.

The lack of identification and guide lights for taxiways and runway intersections causes overroll and excessive braking, as well as excessive use of the engines while landing and taxiing to the ramps during the hours of darkness. These same factors affect the operation of taxiing from a ramp to the runway ends for take-offs.

The additional engine wear and extra gasoline needed for excessive use of engines in ground maneuvers and the high degree of wear on brake linings and tires caused by short stops and sharp turns in 500,000 landings and take-offs are therefore costly.

The poor location of turnoffs and taxiways seriously hampers the use of each port because of the added length of time it takes a plane to clear the runway for the next landing or take-off.

It would therefore be worth while to investigate each field from the standpoint of efficiency for ground maneuvers and to have the proper agencies make design corrections to the taxiways, runway widths, lengths, and airport lighting. The growth of private flying and of air transport activities will eventually cause the cities now served by the air lines to provide numerous small fields for private craft and will also cause the building of fields specifically designed for, and exclusively used by, the air lines.

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A New System of Celestial Navigation

ANDREW D'AURIA

Introduction

All celestial bodies move in a clockwise spherical manner so that the position of the zenith can be determined with angular observations. It is possible to find such a position without using the horizon as a point of reference for angular observations. The North and South poles can be used as points of reference and, in practice, either the magnetic or the gyro compass, provided all errors of the compass can be eliminated at the time of the observations.

This system of celestial navigation does not require the use of a natural or artificial horizon nor the use of a sextant to measure the heights of celestial bodies. The logarithmic and spherical trigonometric calculations are not as involved as in the system of navigation in use today. The system is quite simple and practically reduces astronomic navigation to ordinary navigation in such a way that the navigator can almost consider the stars as landmarks from which he can measure his bearings. In addition to finding the position point, the navigator also determines the error of the compass without any extra calculations.

General Principle

In Fig. 1, N designates the North, S, a star and P the zenith. NPS is the azimuth of star S. Tracing a line perpendicular to half of the azimuth NPS, a curve of position APB is obtained from which all points have the same azimuth NPS. This curve should be classified as a loxodromic and, in a nautical chart, is projected as a straight line crossing all meridians at the same angle.

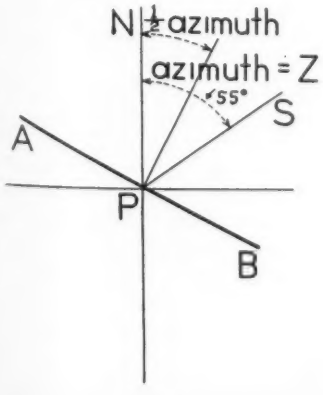


Fig. 1.

The Segment $P_xP_{x_1}$

In Fig. 2, P_x is the estimated position on G_x (estimated latitude) and L_x (estimated longitude). $NP_xS = Z_x$ or the estimated azimuth or the azimuth that would be obtained if the true line of position were $A_xP_xB_x$, the latter being the estimated line of position. $NP_{x_1}S = Z$ or the true or observed azimuth. $A_{x_1}P_{x_1}B_{x_1}$ evidently is the true line of position from which all points will have the same azimuth Z.

The tracing point of this line of position is P_{x_1} being toward the star if $Z > Z_x$ and away from the star if $Z < Z_x$.

The segment $P_xP_{x_1}$ is equal to the difference in azimuths, properly transformed in nautical miles. In order to

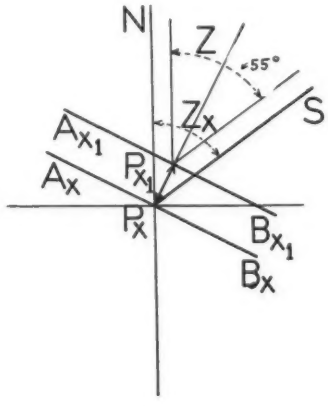


Fig. 2.

obtain this transformation a coefficient is used. This is obtained as follows.

In Fig. 3, N is the North, S a star, and P the zenith. NS^1SQ^1 is the true horizon of P. SPQ^1 is the amplitude of star S.

The arc of the great circle PS^1 is the segment $P_xP_{x_1}$ and is equal to 90 deg. or 5,400 nautical miles. The difference in azimuth is equal to NPS in this case 90° minus the amplitude. If the amplitude of S is 30°, the difference in azimuth will be 60° or 3,600′. Dividing 5,400 by 3,600 the coefficient, which in this case is 1.5, is obtained. Now, referring to Fig. 2, the true azimuth of star S is 55° while the estimated or calculated azimuth should have been 54° 48′. The azimuthal difference being 12′ (minutes of spherical angle), the segment $P_xP_{x_1}$ will be 18 min. (miles), bearing N 27° 24′ E toward the star, and the line of position will be $A_{x_1}P_{x_1}B_{x_1}$

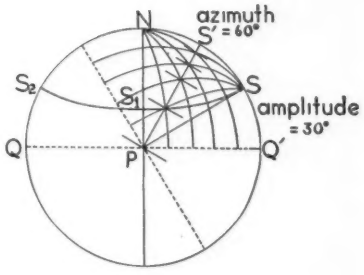


Fig. 3.

crossing at 90° the bearing N 27° 24′ E on the tracing point P_{x_1}.

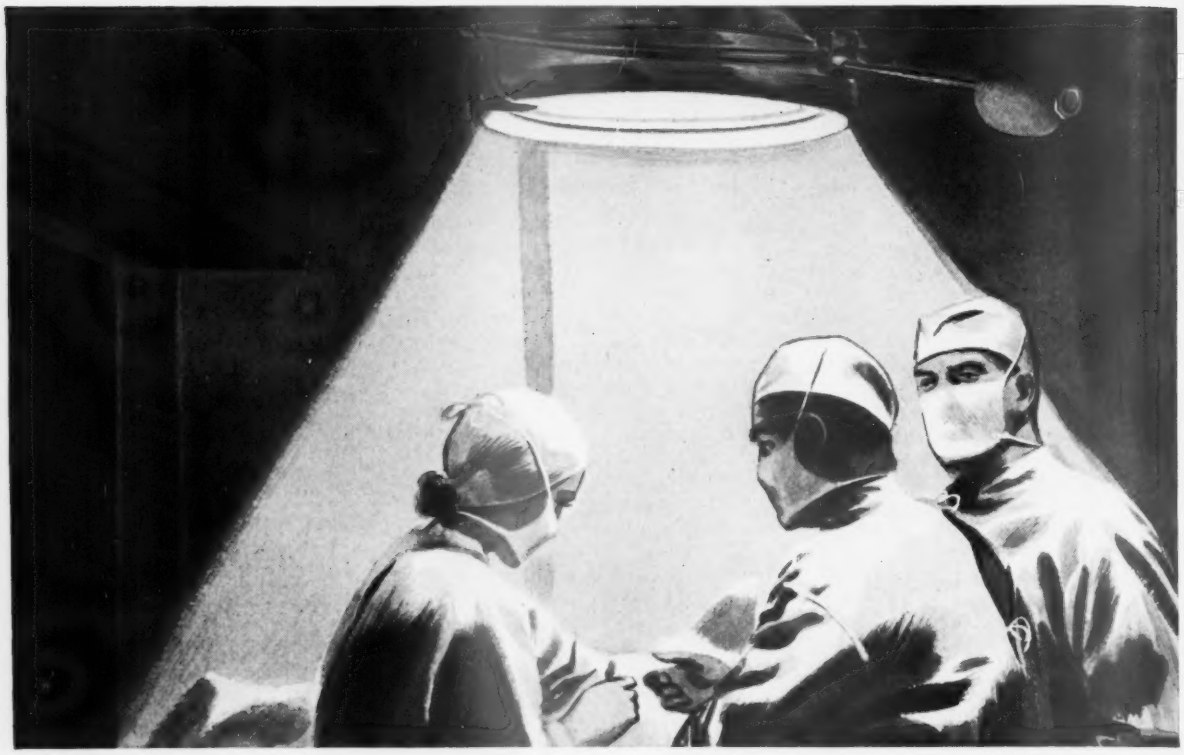
It is convenient here to note that the variations in azimuth as computed in elapsed time are not the same when the star is near the vertical PS as when near the meridian NP. In this latter position the variations are at the maximum, while in the former position they are at the minimum. The variations in azimuth, however, as computed in reference to the vertical, are constant—i.e., for each degree and minute of difference in azimuth, the corresponding difference in degree and minute of arc, as measured on the vertical, is constant. It is obvious, also, that all verticals of the star, on its daily course on the minor circle SS_1S_2, are all equal to 90° from the zenith to the horizon.

Now as in this system the azimuth is computed in reference to the pole toward which the star is seen at its passage through the meridian of observation, (the North Pole is used for all stars passing through the meridian north of the zenith and South Pole for all stars passing through the meridian south of the zenith), it is clear that two stars with the same amplitude but of a different sign and passing through the meridian in a different direction will have the same coefficient in solving the segment $P_xP_{x_1}$.

The Segment Tables

Fig. 4 shows a typical segment table. Such tables, involving the solution of the spherical triangle NPS, on which PS (a vertical equal to 90°) is a constant, are simple to make. The polar distance NS of the star (90° minus the declination) is also a constant. The only variable element of the triangle is the latitude.

The 50 or more stars well known to navigators may now be tabulated, and the coefficient for each may be obtained from latitude 0° to 65° N (or more if



Abandon hope . . . all Germs who enter here

SCIENTISTS HAVE LONG KNOWN that certain wave lengths in the ultraviolet spectrum are true "death rays" to the world of bacteria.

The rays in the narrow region of 2500-2600 Angstrom units . . . about 1/100,000 of an inch in length . . . were found to have the greatest bacteria-killing power.

The problem was to devise a practical and efficient device for transmitting selected ultraviolet radiations within a given bactericidal range.

The device must not generate a lot of heat. It should have long life. It should be inexpensive and easy to install and operate. Most of its radiation must be in the region of peak bactericidal effectiveness. It must produce only a limited amount of ozone.

Some years ago one of the scientists of the Westinghouse (Lamp Division) Research Laboratory, which is under the direction of Dr. Harvey C. Rentschler, produced an ultraviolet generator meeting these difficult requirements.

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SPECIMEN TABLE
Name of Stars in Alphabetical Order

Latitude	Aldebaran	Arcturus	Bellatrix	Denebola	Pollux	Sirius	Vaga	Etc. →	Etc. →
0° 00′									
10′									
20′									
30′									
40′									
50′									
1° 00′									
10′									
20′									

FIG. 4.

desired) and similarly from 0° to 65° S. The approximations should be in 5′ or 10′ steps, as shown on Fig. 4.

INSTRUMENTS NECESSARY

An azimuthal circle reading in minutes should be constructed. This is comparatively simple, being similar to the many in use and involving only a telescope, rotatable in azimuth and pivoted for vertical elevation. The instrument should have a bubble for leveling if it is to be used on the gyro compass of an airplane, while on a naval compass it will rest with the cardamic suspension of the compass. A lens assembly with an index prism could be used instead of the telescope, making it more convenient for the navigator to use. However, the only reading to be obtained from this instrument is the azimuth or compass bearing to the accuracy of 1′. Although the telescope or, in the lens assembly, the index prism is vertically adjustable, no vertical adjustment reading is used. The only reason for the vertical and horizontal rotatable mountings being used is to enable the navigator to sight on a celestial body.

The particular construction recommended in this instrument is the graduated minute sector, shown on Fig. 5.

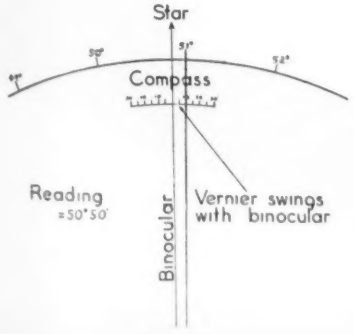

FIG. 5.

This will provide for easy and quick sighting in reading the azimuth in degrees and minutes. This sector swings with the sighting means in the horizontal plane over the face of the compass card so that, with proper magnification, the navigator sees one of the degree markings of the compass card with the minute sector adjacent. If the degree reading of the card is at the left of the centerline of the sector, the minutes are added. If the degree reading is at the right of the centerline, as it is on Fig. 5, the minute readings are subtracted.

This is only to provide a quick and accurate method of getting a reading of the azimuth in degrees and minutes without making a compass with a compass card of a large size having the minutes actually inscribed on the card.

ERRORS OF THE COMPASS

As a general rule, the system of navigation in use today divides all errors into two groups: constant and accidental.

It is hard to establish a complete line of division between the two kinds of errors. In any event, all theories point to the same purpose—elimination of all errors as much as possible—hence, the theory of "boxing in" the position of the zenith with several lines of position.

The major error to deal with in this case is the error of the compass at the time of the observations. Such an error can be classified as constant and can be either totally or partially eliminated.

In Fig. 6 P is the true position point; N, the true north; and S_1 and S_2 two stars having the same amplitude and consequently the same coefficient.

It is clear that if there is an error of 40′ on the compass at the time of observations, such as to displace N to N', such an error will be of minus sign for the star S_1 and of plus sign for the star S_2, while the bisector BPX will be the same for both couples of line of position—the erroneous and the true.

The same solution can be applied using two other stars, S_3 and S_4, with the same amplitude of S_1 and S_2 but of a different sign, and passing through the meridian south of the zenith (and consequently with the same coefficient). It will then be found that the error under consideration will be of plus sign in S_3 and minus in S_4.

It therefore appears clear that the position point P would have been the same, even if the four lines of position influenced by the error of the compass had been used, these four lines being shown in the illustration by dotted lines.

Of course, such a combination of stars is ideal. However, the navigator can choose his stars approximating such an

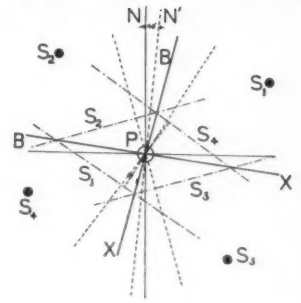

FIG. 6.

ideal combination, since in a small space of the celestial sphere he can often choose six or eight stars, as in the group of the Orionis.

With study, practice and good judgment, a navigator can familiarize himself with the different positions of stars and their spherical elements and can master the practical execution of the whole system.

Fig. 7 shows a typical point obtained with three celestial bodies. Position point P is actually outside the triangle ABC formed by the three lines of position S_1, S_2 and S_4. In order to eliminate any error or confusion in tracing the bisectors, it is suggested that the following rule be applied:

The bisector of the lines of position of two stars having opposite direction leaves the two stars on opposite sides, while the bisector of the lines of position of two consecutive stars leaves the two stars both in one side.

This is clearly illustrated in Fig. 7, where the correct bisectors are shown with heavy dotted lines and the incorrect are shown with light dotted lines.

It will also be noted on Fig. 7 that the position of each star has been marked directly on the line of the half azimuth. It is convenient to consider the position of a star on this line, between the pole and the star, as this is the real point of reference toward which the line of position is drawn.

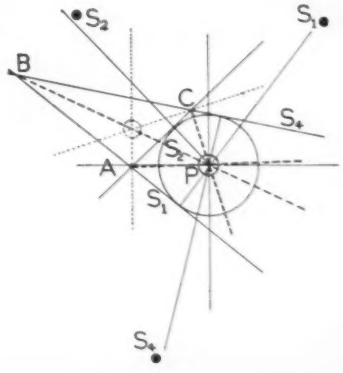

FIG. 7.

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Conclusions

The system has the following advantages:

(1) It reduces celestial navigation to ordinary navigation using stars instead of landmarks.

(2) While speed has increased, particularly in air transportation, no simple and quick method has been brought forth to "box in" points. It is believed that this system offers this simplicity and speed of operation.

(3) The point can be obtained at any time at night. During the day a good point can be obtained with the Sun in conjunction with the Moon and Venus, if visible.

(4) The compass may also be used for finding positions.

(5) In the case of a gyro compass, as used in aviation, the resetting with the magnetic compass is reversed. Actually, the navigator can check the magnetic compass.

(6) After "boxing in" a point the navigator, besides finding the position, actually determines the error of the compass, as shown on Fig. 6.

(7) The advantage is obvious in navigation through the magnetic poles or in places with large and rapidly changing magnetic declination or magnetic storms.

(8) The navigator can prepare his figures in advance. In this manner the position is obtained in a short time after the actual observations.

The weakness of this method is apparently in measuring the azimuth with accuracy. The graduated minute sector as proposed is intended to enable a navigator to measure azimuth to the accuracy of 1′. The oscillations of the magnetic compass or, to a much lesser extent, those of the gyro compass will be more apparent through a magnified reading. However, one may safely assume the next oscillation to be of the same amplitude of the preceding and, mentally, read the average.

The error of the compass, as treated previously, is the sum of all errors that may be considered as constant in this method. The error, no matter how large, will be eliminated and determined. As previously stated, if a gyro compass is arbitrarily set toward the north and a position obtained, in actually finding the position the navigator will also find how far from the true north the north of the gyro compass had been set.

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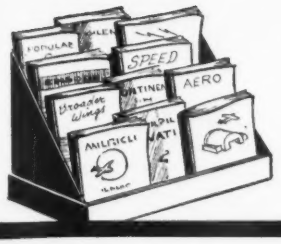

Periodicals

Accessories

Auxiliary Power Vital Today. Blake Reynolds. Growing requirements for power for starting high-powered main engines and operation of auxiliaries and accessories in large aircraft have led to the development of independent power systems for these purposes. Methods for obtaining auxiliary power in earlier airplanes are reviewed, including air-driven generators, main-engine-driven generators, batteries and hydraulic systems, most of which relied upon the motion of the airplane or could be used only when the main engine was running. Exigencies of war have brought many situations wherein independent power is necessary, such as signalling from the ground or surface of the sea, and for work when the plane is at rest, such as loading bombs or cargo and supplying lights and heat. Starting main engines and operating gun turrets, landing gear and flaps are among other principal functions of auxiliary power units for large aircraft.

Auxiliary power plants are described which are intended to operate with the regular electrical and hydraulic systems or independently. One plant of this type, the Lawrance Model 30 V, is detailed and specifications are tabulated. A 15-hp., two-cylinder, horizontally opposed, air-cooled engine drives a 5-kw. direct-current generator. Particulars of the construction of the engine, generator and accessories are set forth. It is indicated that the future will bring a greatly expanded field for the development and use of auxiliary power plants. *Aviation*, September, 1942, pages 112–115, 317, 6 illus.

Air Cargo

Postwar Cargo Lines to Demand New Designs. E. J. Foley. Overemphasis has been placed on the idea that after the Armistice practically all cargo will be carried by air, the writer believes. The increased movement of military cargo by air undoubtedly will assist in the ultimate achievement of an extensive air freight service. But an overnight change to mass commercial air service is unlikely. Probably the long-haul portion of air cargo will receive the greatest immediate postwar impetus. Problems connected with cargo airports and landing strips at factory sides are discussed. The latter are limiting factors as to the size of aircraft to be used. Small aircraft may be necessary to circumvent one of these limitations which precludes the possibility of all cargo by air in the early postwar period. Speaking of small aircraft for shuttle service, the writer suggests that the helicopter may offer possibilities. *American Aviation*, September 1, 1942, page 40, 1 illus.

Air Cargo in Peril. The writer believes that there are both meritorious and objectionable angles to the proposals of shipbuilders Henry J. Kaiser and Andrew Jackson Higgins for the replacement of unfinished surface freighters with huge flying boats that could transport men and material without risk of being torpedoed. The writer believes that the Kaiser and Higgins organizations should be welded into a big aircraft pool as subcontractors to the existing aeronautical industry. *Southern Flight*, August, 1942, page 18, 1 illus.

Subs Can't Get Air Cargo. Lawrence Black. The writer believes that General Forrest's well-remembered saying that winning battles is just a matter of "getting there fustest with the mostest" still holds true and is convinced that the modern solution to the problem is air transport. The shortage of transportation facilities undoubtedly is the greatest obstacle to seizure of the initiative by the Allies. Some information and figures on the large-scale transportation of heavy goods by air are furnished. *Western Flying*, August, 1942, pages 44, 45, 84, 86, 2 illus.

Strato-Frosting Foods . . . Post-War

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HELP FOR THE MAN ON THE MACHINE

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ALCOA ALUMINUM

Job for Aviation. Ralph V. Grayson. An engineer familiar with the frozen food industry suggests the strato-frosting of fresh foods as an industrial means for absorbing some of the post-war surplus of airplanes and providing employment for pilots. The nation now has airplanes that can fly safely in the substratosphere and has trained pilots who may be eager for employment after the war. It is believed aviation will take its place in the frozen food industry after the war. Advantages to be gained from the strato-frosting of foods are enumerated. One of these is the clean, rarified air that can be directed over the honeycomb of packages within the fuselage. Under normal atmospheric conditions a temperature of −45°F. can be reached at an altitude of about 28,000 ft., it is stated. A strato-froster will carry from 4 to 8 tons per frosting flight. The mobility of the equipment provides the means for all-year operation. A typical strato-froster with sectional drawings is shown to illustrate how standard transport planes can be modified for this food-frosting system. *Southern Flight*, August, 1942, pages 27, 28, 2 illus.

Air Law

Canadian Law of Civil Aviation 1937–1942. B. V. Richardson. This article supplements and endeavors to bring up to date a paper on the same subject delivered by the writer before the Canadian Bar Association in 1937. Further and more recent changes are incorporated in the present discourse. Statute law dealing with aeronautics is traced briefly from the original Air Board Act passed in 1929. Constitutional aspects are considered on the basis of the reconciliation of Dominion legislation with various provincial laws and comments are made on the respective jurisdictions of the Dominion and the Provinces.

The major part of the paper is devoted to the subject of negligence, numerous cases and decisions being cited which have a bearing on the responsibility of air-line carriers. Cases are mentioned involving the acts of pilots and other employees of air carriers, as well as cases involving failures of aircraft and their parts. Another aspect considered is the limitation of liability of an air carrier by contract under which the passenger or shipper waives claims for recovery of damages by signing or accepting limiting clauses in connection with the tickets or other documents evidencing contracts for transportation. One such case, said to be unreported as yet in any law publication, is set forth in considerable detail. *The Journal of Air Law and Commerce*, July, 1942, pages 195–211.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

Air Policy

Air Intelligence. Charles E. H. Medhurst. The Assistant Chief of the Air Staff (Intelligence) explains how the intelligence staff of the Royal Air Forces assembles, evaluates and disseminates in an accurate and digested form a mass of information from every conceivable source and places it before the air force commanders so that they may use it for planning their operations. He tells how snatches of information drift in, are patched together and interpreted. The primary function of the Intelligence Division is declared to be discovering the strategic plan of the enemy. To this is added the job of assessing the strength of the enemy's internal economic system, what his production of guns and ammunition may be, the depths of his reserves and the extent to which his battle strength can be maintained. The Intelligence Division must also gauge the enemy's stores of food and raw materials and the morale of the civilian population. Shipping, road transport, locomotives and rolling stock must be estimated not only in numerical terms but also in terms of probable efficiency. *Flying and Popular Aviation*, September, 1942, pages 141, 196, 200, 202, 204, 4 illus.

Air Power

Air Power Comes of Age. Major Nathaniel F. Silsbee. Although giving full credit to the necessity for ground forces and navies as important members of the team that constitutes American military strength, the writer emphasizes the dominant position assumed by air power. He endeavors to answer the question as to what has happened to give air power this dominant position and why air power has proved itself with such dramatic suddenness. The important parts that have been played by military aviation in all the major campaigns of the present war are traced. All of the various units that constitute air power are defined. It is held that the major factors of success in aerial warfare involve a campaign of three elements: aircraft carriers, land-based aircraft and efficient air bases. The lack of such bases is assigned as one reason that has hitherto prevented the American air forces from striking the offensive blows of which it is capable.

The writer then analyzes the functions of air power on the basis of what it does, not what it is. Three functions are outlined, the first being co-operation between land forces and sea forces; the second, conduct of independent warfare from the air; and the third, a new function that is just appearing. This last factor involves the actual occupation of territory by an air force through the use of transport planes, parachute troops, air infantry, light tanks, artillery and other equipment. Glider trains are included in this function. Examples of these three factors are cited, and the possibility of the opening of a second front by air is explored. The aircraft equipment and the air organization in current use are reviewed and the article concludes with the statement that offensive warfare led by air power is the way to victory. *National Aeronautics*, August, 1942, pages 11–13, 30, 4 illus.; *Airlanes*, August, 1942, pages 2, 3, 17, 2 illus.

Japan's Air Power Is Doomed. Lucien Zacharoff. An attempt is made to evaluate the power of the Japanese air forces. Recalling that numerous erroneous ideas had prevailed prior to a demonstration of Japanese air strength, the myth of invincibility of the Zero aircraft is said to have been exploded. The writer recalls that for a long time he had been emphasizing the strength of the Japanese army and navy and their preparedness and other advantages, and he states that these are the underlying reasons for the success of the enemy up to the present. However, it is again brought out that the Japanese should not be underestimated. The weak points in the enemy's air arm are probed, and the writer again makes the prediction that eventually the Allies will prevail in the air. *National Aeronautics*, August, 1942, pages 16, 17, 43, 5 illus.

Air Power in War. Charles Portal. Britain's Chief of Air Staff reviews the role that air superiority has played in the war, emphasizing the fact that it is as necessary for land and sea battles as it is for purely aerial ones. He evaluates the strength of the Royal Air Force from the early days of the war, through its period of growth, until the present time when it is nearing its goal of being powerful enough to destroy German industry at a rate which outstrips repair.

Read 'em and Weep

(for the Japs — if you can)

The Bomber That Broke the Japs' Hearts at Midway

smooth song of power
)0 horsepower engines,
ces' newest champion
through its paces over
the hands of Uncle
MacDill field.
Martin B-26 medium
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their valiant crews did not return to their bases, but the score was 10 men and two $200,000 planes for two Jap carriers, each carrying over 1000 men in its crew and worth several million dollars. And adding to the score, the planes from the enemy carriers, which found no place to roost, went down in the Pacific.

* * *

The B-26's scored again in the battle of the Aleutians by sinking a cruiser and putting an aircraft carrier out of action.

They also struck hard at Cologne in Germany, in the Mediterranean, and in Coral sea, proving that whether the objective is an enemy base on land or a battleship at sea, the medium-size, medium range, but tremendously swift medium bomber, of which the 26 is today's shining example, can blast it at smaller loss than any other weapon.

Brig. Gen. Jimmy Doolittle has let the world know what he thought of the B-26 by using one on various military missions since he led the raid on Tokyo. That particular job was done in Consolidated B-25's which is just about as effective as its sister 26 but not quite as fast. It was General Doolittle who gave MacDill and Tampa their first glimpse of the 26 when he landed here about six weeks ago.

* * *

What makes the B-26 one of the most potent bomber-torpedo planes in the world today? Just a look at it will

MARTIN BOMBERS SINK JAP CRUISER

Direct Hit Scored On Plane Carrier In Aleutian Island Battle

United States torpedo planes sank a Japanese cruiser and scored a direct hit on an aircraft carrier of the main Japan[illegible] task force attacking the Aleutian Islands, it was flying Martin B-26's as torpedo

Allies Compare Planes:

Martin Bombers Best Against Foe

By HAROLD GUARD
United Press Staff Correspondent.

SOMEWHERE IN AUSTRALIA, Aug. 7.—Eight months of war have taught the Allies that pre-Pearl Harbor conceptions of the Japanese as poor fliers using inferior planes were wrong.

Any American pilot will tell you that the Japanese flier knows the score and that the improved Zero plane is one of the world's finest fighters.

The fact that Allied planes have proved a match for Zeroes on the 2,000-mile front north of Australia is a tribute to their pilots' flying ability.

MARTIN B-26 BEST

The American-made fighters that go against the Zeros are the Bell Airacobra and the Curtiss Kittyhawk, but it is the Martin twin-motored Marauder bomber—the B-26—that battle reports show to be the most effective.

American pilots like their own planes but they frequently express a wish that they had a little more of the Zero's all-around capabilities, especially its ability to climb fast and get on top in combat and its wide operational range.

Every pilot tried to get above his opponent in a dogfight and that's where the Japanese plane seems to have the edge. I recall an occasion in which several pilots told of surrounding a lone Zero. They figured they had it tagged. One said:

embodied in its construction. The engine is of the Pratt & Whitney type. German and American ideas are noted in the instrument panel arrangements.

Many structural features ape those of the British Hurricane and the armament is much like that of British fighters.

It was tested for years against the Chinese, for the Japanese apparently used China as a laboratory for the machines they later used against the United Nations.

FARES BETTER

A study of Army communiques shows that the Martin bomber has fared better against the Japanese than the Airacobras and the Kittyhawks. The Zero can outrace the twin-motored heavier Martin, but it can't outgun it and it cannot take the steep dives or fly at low level with the American plane.

Once the B-26 is in the air it can take care of itself, and pilots say the Japanese have a healthy respect for it. There have been instances where a B-26's cannon literally tore Zeros to pieces, and many pilots believe that the best plane to whip the Zero will be one somewhere between the B-26

Martin

B-26 BOMBE

Builders of Dependable *Aircraft Since 1909*

The conditions of dispersal under which the Royal Air Force had to work in the past—and under which to a considerable extent they are still working—are explained. With a multiplicity of fighting fronts and the necessity for being strong at essential points, a relative weakness at other points could not be prevented. However, the writer states that conditions are constantly improving and gives reasons why. He outlines the factors to be considered in building up the various portions of the air force. . . . defense planes, striking power, transports, etc. A report is also given of the recent large-scale bombing raids on Germany. *Flying and Popular Aviation*, September, 1942, pages 40, 234, 236, 1 illus.

Japanese Air Power. E. Speyer. An analysis of Japan's aircraft strength which supports the view that the United Nations have been too prone to underestimate their productivity. The writer indicates that his conclusions are drawn from plans and statistics published in Japan, from figures relating to the trade between Japan and other nations, and from public speeches by Japanese government, military and business authorities. After a brief history of their air forces, he presents estimates on the production of Japanese aircraft for each of the years from 1933 through 1941. Figures are also given for the value of American airplanes imported from 1936 to 1940.

The article surveys the control and sponsorship of the aircraft industry by the Nipponese government. It explains how predominant has been Japan's aim to become independent in the production of war materials and discusses the question of how she obtains necessary metals. The conclusion is reached that she has access to a sufficient amount to permit the expansion of her aircraft industry and that to hinder this a program of bombing her industrial plants, ports, and shipping must be instituted. *Aviation*, September, 1942, pages 94–97, 317, 318, 8 illus.

The Organisation of the Royal Air Force. C. L. Courtney. A survey by the Air Member of the Air Council for Supply and Organization on how Britain organizes and employs her aircraft to meet the conditions and tasks with which she is confronted. Although the Royal Air Force is a *separate* service, it is not *independent* of the Army and Navy but works with them where its versatility and flexibility can be employed to the greatest advantage.

Partly on a functional and partly on a geographic basis the British Air Arm is divided into a series of commands. The Bomber Command consists of the main force of bomber aircraft. The Fighter Command is made up of the main force of fighter aircraft. There is in addition the Coastal Command, Army Cooperation Command, Maintenance Command, two Training Commands (Flying Training and Technical Training), Balloon Command, and Ferry Command. On the geographic basis the commands are divided into the Middle East, India, and East Africa, each operating bomber, fighter, and other types of aircraft.

The article includes a diagrammatic layout of the structure of the Air Council. It also discusses the various types of aircraft in operation. *Flying and Popular Aviation*, September, 1942, pages 41, 42, 252, 1 illus.

What's Become of the Luftwaffe. . .? Lucien Zacharoff. This discussion of German air power upholds the point of view that there has been an apparent decline in the relative strength of the Luftwaffe. The writer dwells upon the inferiorities of various German airplanes—Messerschmitts, Heinkels, Focke-Wulfs, etc.—and points out that in many ways they are unsuitable for the Russian campaigns. He also reports that the Soviet bombers and fighters are said to be faster than those of their adversaries.

German fuel shortage and inadequacies of her fliers receive comment. In reference to the latest fighting tactics of the Luftwaffe it is claimed that because of the crisis in equipment, leadership and personnel, these also show many disadvantageous modifications. *Aviation*, September, 1942, pages 98, 99, 276, 279, 280, 283, 3 illus.

International Air Control. Group Capt. R. E. G. Fuljames. The writer believes that serious attention should be given to Lord Brabazon's suggestion that to avoid future aggression the United Nations should take charge of all aircraft so that no nation shall build up an air force for mischief. The idea of an international flying police force is discussed. *Flight*, July 30, 1942, page 128.

Awakening of Air Power. A forecast of United States air might is based upon a day-by-day review of American air operations throughout the world for the period June 1–July 6, 1942. The conclusion is that although this country's strength is as yet spread too thinly the successful record of these offensive operations demonstrates what will happen when American man power and machine power achieve their maximum. The article states that United Nation's air control exists over Western Europe and over the Australian fighting line and seems to be imminent in the Burma section, but that it is contested over the Mediterranean. *Aviation*, September, 1942, pages 102, 103, 305, 306, 309, 310, 313, 4 illus.

Air Safety

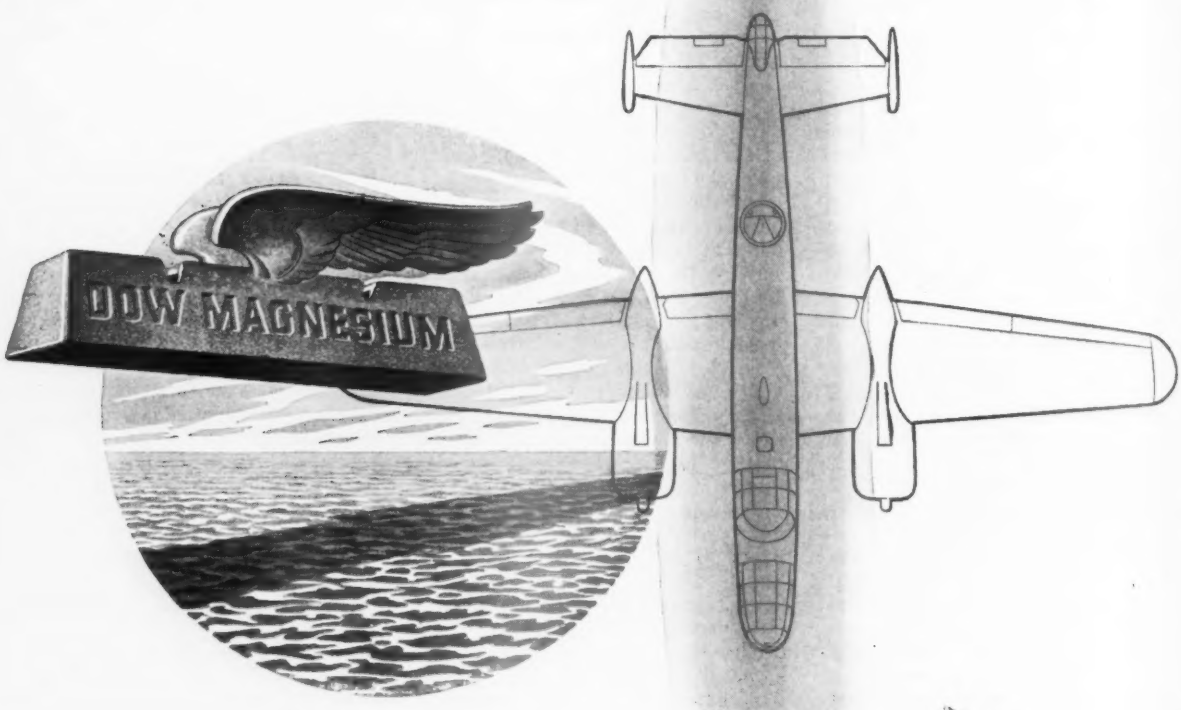
"Keep 'Em Flying"—Safely. John Stearns. The Army Air Forces intends to cut the toll of aircraft accidents through a program of pilot instruction designed to eliminate factors of carelessness in flying, the writer explains. The program is specifically designed to advance the efficiency of our military aviation but is also one that can be adopted to allow full growth of postwar civilian flying with a minimum of accidents. Details of a postwar safety program for civil aviation are discussed. *U.S. Air Services*, September, 1942, pages 21, 24, 1 illus.

Air Transport

Sources of Feeder Airline Business. Part II. John H. Frederick and William J. Hudson. This is the third in a series of articles on feeder air lines. In this installment, air-mail routes are discussed and air-mail rates are explained. The volume of different classes of mail are compared, it being shown that the ratio of air mail to the total first-class mail and to the volume of all mail transported is a more valid relationship than a comparison of the volume and value of the service with some preceding year or years. It is held probable that should all first-class mail be sent by air at the present rate, there would be a considerable shift in volume from the lower classes of ground mail to air mail. A comparison is made of the revenues and expenditures for different classes of mail. Figures are tabulated for the distribution of revenues and expenses, ratios by geographic divisions, cities served by air mail and proposed to be served. Conclusions are drawn that the inauguration of proposed extensions of feeder air-mail service would favorably affect the ratio of air mail to other first-class volume, except in certain localities where special conditions are mentioned, and that the extension of independent feeder air-line pickup and delivery should be encouraged. *The Journal of Air Law and Commerce*, July, 1942, pages 212–227.

Air Transport Auxiliary Service. Eric Vansittart Bowater. The Air Transport Auxiliary is responsible for the delivery of all planes within Great Britain used by the Royal Air Force except those flown across the Atlantic by the R.A.F. Ferry Command. This article surveys the development of the A.T.A., outlines its

DOW



PIONEER producer of magnesium and developer of the techniques for the fabrication of this lightest of structural metals, Dow has accumulated twenty years of service data. It is on this great bank of experience that designers draw in their use of magnesium for the construction of aircraft and other wartime equipment.

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functions, and describes the many types of people that comprise its personnel. It also depicts the difficulties that confront these civil pilots flying alone to deliver British war planes from factory to airdrome. *Flying and Popular Aviation*, September, 1942, pages 172, 173, 260, 7 illus.

An Air Transport Goes to War! Kram E. Sliven. Conversion of a design originally intended for an outstanding luxury airliner into a heavy-duty army transport plane is recounted. This is the story of the development of the Curtiss Commando, which can carry troops, scout cars, trucks, tractors, aircraft engines or other kinds of military supplies and equipment. Its cargo capacity is said to be such that 35 planes of its type could have equalled the work performed by 7,700 trucks which in one recent month carried about 30,000 tons of materials over the Burma Road into China. Recent tests are related which demonstrated how quickly the plane can load and discharge troops and motorized equipment. *Airlanes*, August, 1942, pages 4, 5, 20, 5 illus.

Wings Over the North. Part two of a series of articles narrating flight operations that were the forerunner of commercial aviation in Canada. The development of air-mail service to 1929, when service was carried to the scattered settlements reaching as far north as the Arctic Ocean, is described. *Canadian Aviation*, August, 1942, pages 43–45, 7 illus.

Ferry Command Birthday. The first birthday of the Royal Air Force Atlantic Ferry Command prompts a survey of the Command and its year of accomplishment. Following a description of the main British terminal airfield, the Command's development from its inception as Atlantic Ferrying Organization is marked. The article also discusses the aircraft flown, conditions of flight, average time of crossings, unusual trips that have been made, and the weather reports and signals used.

One portion of the article deals with the air crews of the Ferry Command. In listing the qualifications for pilots, they are divided into four main groups, three Service and one civilian. These are: (1) commissioned and noncommissioned pilots who have been trained under the Commonwealth Air Training Scheme; (2) qualified pilots and instructors who have been on duty in the United States or Canada; (3) United Nations' pilots who have received the same training in Canada as the British eligibles; (4) civil pilots who have 750 hours solo to their credit and hold a B license. *Flight*, July 23, 1942, pages 87–90, 12 illus.; "Ferry Command," Frederick W. Bowhill, *Flying and Popular Aviation*, September, 1942, pages 102–104, 256,258, 8 illus.

There are No Submarines in the Air. Col. Royal B. Lord. A plea for the immediate quantity production of cargo planes. The feasibility of this type of transportation is explained and its advantages over other methods are listed. Presenting the thesis that air transports are urgently needed, the article demonstrates that this nation has the skill, materials, facilities, and knowledge to make them, as well as the operating experience to keep them flying. *Collier's*, August 29, 1942, pages 17, 18, 2 illus.

Aircraft Spotting

How You Can Learn in Five Minutes to Spot Planes. Silhouettes of different types of United States airplanes are shown and a brief outline of their characteristics is appended to make possible quick identification. Any airplane not possessing the typical characteristics of these silhouettes is probably hostile, it is stated. The illustrations show the shape of the wings and wing tips, how they are attached to the fuselage, the position of the cockpit, construction of the tail, the wing spread, and engine and nose design. *Popular Science*, October, 1942, pages 98, 99, 8 illus.

Airplane Descriptions

Enemy Aircraft Outlined. A brief description with three-view drawings of German reconnaissance, fighter and trainer aircraft is furnished. These include the Focke-Wulf FW 187 twin-engined fighter; the Focke-Wulf FW 189 trainer; the Arado Au 96 fleet spotter, carried on numerous German warships; the Heinkel He 115 float plane; and the Focke-Wulf FW 58 twin-engined reconnaissance plane fitted with Argus engines. Details of these aircraft were taken from German sources. *Aeronautics*, August, 1942, page 47, 5 illus.

Typical Soviet Aircraft. Characteristics and three-view silhouettes of some Soviet Air Force planes are presented. Among the fighters are the MIG-3 and the YAK-1. The bombers include the DB-3, SB-3, and the PE-2. Others are the IL-2, the YAK-4, the SU-2, and the MBR-2. *Aviation*, September, 1942, pages 100, 286, 9 illus.

Wings for the Navy. Official photographs and a brief description of United States Naval aircraft. The article covers the principal combat aircraft of American sea forces and gives some unofficial performance figures. Illustrations include the Grumman F4F-3 Wildcat, the Douglas TBD-1 Devastator, the Douglas SBD-1, the Brewster SB2A-1 Buccaneer, the Vought-Sikorsky OS2U-2 Kingfisher, the Curtiss SO3C-1 Seagull, the Consolidated PB2Y-2, the PBY-5A, the PBY-5 Catalina, the Martin PBM-1 Mariner, and some of the aircraft carrier "Saratoga's" complement of 83 airplanes on her deck. *Army Ordnance*, September–October, 1942, pages 293–300, 15 illus.

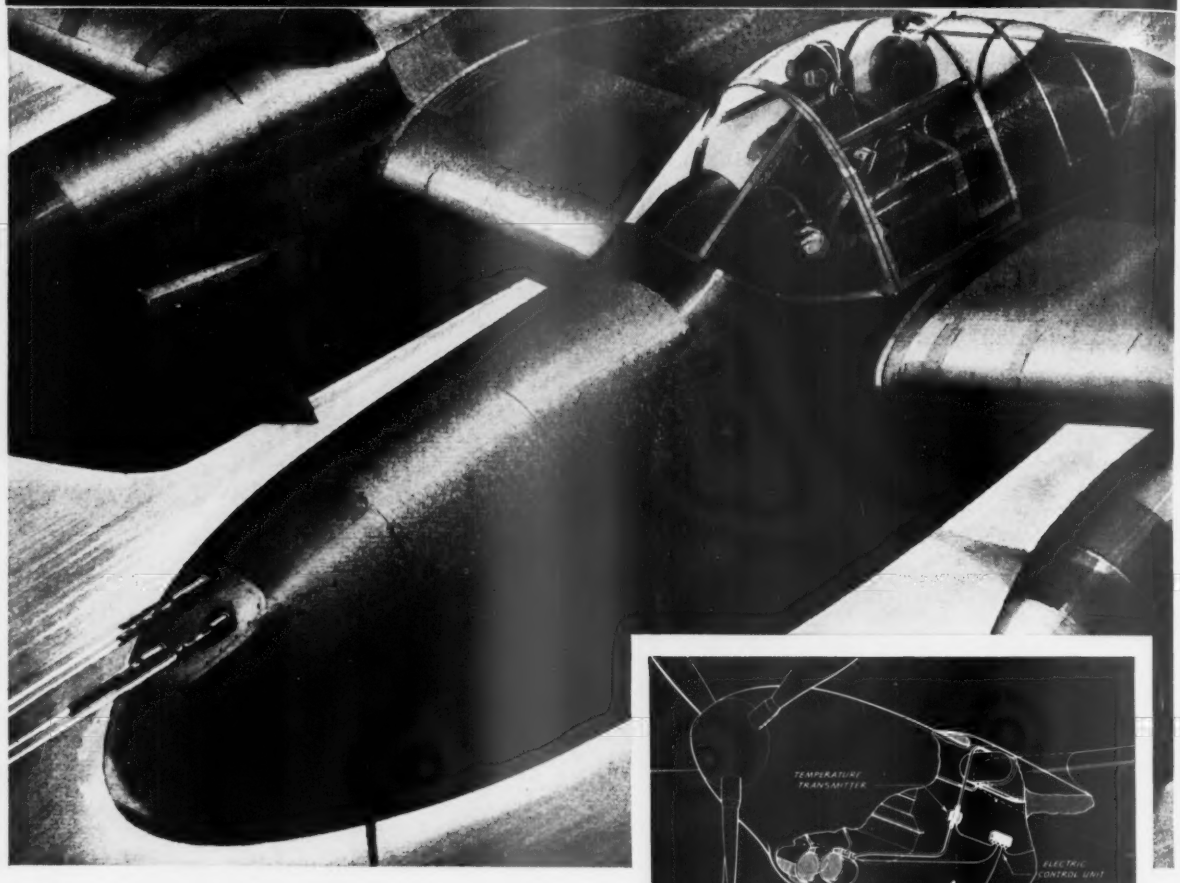
The Consolidated Catalina Flying Boat. Pictorial drawings show the external and internal construction of the Consolidated Catalina flying boat. Some dimensions and performance data are given. *Automotive and Aviation Industries*, August 15, 1942, pages 30, 31, 4 illus.

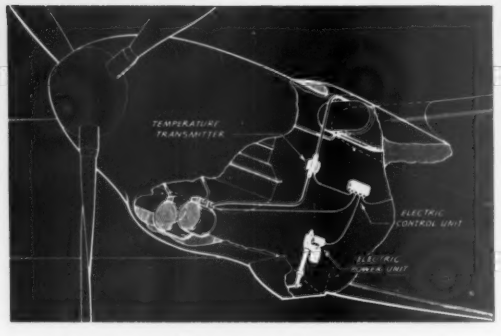
British Aircraft. John S. Buchanan. Data on the principal types of British aircraft are included in a survey by the Director-General of Aircraft Production on how Britain has developed her aircraft since war began. Technical details are submitted on the three latest-type bombers: the Short Stirling, the Handley Page Halifax, and the Avro Lancaster. Other aircraft noted are the Hurricane, the Spitfire, the Wellington, the Manchester, the Short Sunderland flying boat, the Bristol Beaufort, and the de Havilland Tiger Moth. *Flying and Popular Aviation*, September, 1942, pages 159, 160, 258, 259, 5 illus.

"0" Planes Cover Miles in Minutes for the U.S. Army. Illustrations of several current types of observation planes used by the Army Air Forces are accompanied by brief descriptions of the services they perform. A tabulation shows the type designation of the Army's observation planes from 1925 to 1942, including the names, numbers and engines installed. *Air News*, September, 1942, page 30, 6 illus.

Aircraft Types and Their Characteristics. Illustrated by photographs and diagrams, dimensions and descriptions are given of the Hurricane 11B and the Mustang. Powered by a Merlin XX with two-speed supercharger, the Hurricane 11B has a maximum power with the low-gear supercharge of 1,260 hp. at 12,250 ft. and a maximum with the high gear of 1,175 hp. at 21,000 ft. Its chief function is that of low-level attack and its armament comprises machine guns in the wings and externally housed

To help him concentrate on gunfire...





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Now, with Automatic Exit Flap Control ready to "take over," our fighter pilots will be freed from considerable instrument watching.

The AiResearch *Automatic Exit Flap Control System* — developed by our engineers in cooperation with other aircraft engineers — will give our pilots several advantages.

This new control system forestalls congealing. It cuts open-flap time... on many planes this can mean from 10 to 20 extra miles speed per hour.

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Adaptable, the system operates on 24 volt D. C. supply and may be used on every type of airplane — with intercoolers, liquid coolant radiators and engine oil coolers.

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bombs beneath the wings, just outside the center section.

The Mustang, produced by North American Aviation, Inc., has a liquid-cooled, twelve-cylinder, in-line Allison engine with a maximum power output of 1,150 hp. at 3,000 r.p.m. at 12,000 ft. and a cruising rating of 1,000 hp. at 2,600 r.p.m. at 10,800 ft. The original armament plan provides for three machine guns in each wing.

Descriptive and specification data are presented on the Focke-Wulf FW 190 and Messerschmitt Me 109F. The former is termed the cleanest form of single-seater fighter, aerodynamically, which has been evolved by Germany. It is powered by a 14-cylinder, two-row, air-cooled, radial B.M.W. 801 engine.

The Messerschmitt Me 109F is a development of the original Me 109E, with the chief changes in the wings and tail mounting. Its engine is a Mercedes-Benz BD-601N with flat-topped pistons. The top speed of the Me 109F is said to be 380 m.p.h. at 21,000 ft. and its ceiling 40,000 ft. *Flight*, July 16, 1942, pages 66a, 66b, 2 illus.; July 23, 1942, pages 92a, 92b, 2 illus.

A Curtiss Seagull scout-observation plane undergoing rough water tests. The Seagull is a two-place, mid-wing monoplane equipped for either land-based operations or for catapult operations from battleships or cruisers.

American Aircraft in the RAF. A review of the United States manufactured airplanes being used by the Royal Air Force. The article points out that the adaptability and versatility of American airplanes have far outweighed in importance any alterations in their armament and equipment necessitated by operational and climatic conditions. Among the airplanes commented upon are: the Lockheed Hudson, the Consolidated Catalina, the Martin Maryland, the Douglas Boston III and Havoc, the Curtiss Tomahawk and Kittyhawk, the Boeing Flying Fortress and the Grumman Martlet. *Flying and Popular Aviation*, September, 1942, pages 161, 274, 1 illus.

Spitfire "V" Fighter in Production. A two-part article giving features of the Vickers-Supermarine Spitfire. In its latest form this fighter is known as the Mark V. Experience gained by the Supermarine Company in the building of 1931 Schneider Trophy monoplanes was instrumental in development of the Spitfire. Stressed-skin construction was relatively new at that time, and the Spitfire was not primarily designed for ease of manufacture. Much development was necessary to attain large-scale production. In the first part of the article construction and assembly methods are discussed in considerable detail. Wing construction is given special consideration. The second part of the article deals with the fuselage and other components of this aircraft. Drawings and photographs aid in the presentation. *Automotive and Aviation Industries*, August 15, 1942, pages 36, 39, 82, 8 illus.; September 1, 1942, pages 34–37, 72, 9 illus.

America's Fastest Fighter. This article describes the Republic Thunderbolt, which is referred to as the American interpretation of a single-engined 2,000-plus hp., 400 m.p.h. fighter. This aircraft is powered with the Pratt & Whitney Double Wasp engine. It is said the Thunderbolt has reached a speed of 680 m.p.h. in diving tests. *Flight*, July 30, 1942, page 120, 2 illus.

British Night Guardians. Descriptive and specification data are presented on the Boulton Paul Defiant, British two-seater fighter. A single-engined low-wing monoplane, the Defiant is said to have a speed of over 300 m.p.h. An unusual characteristic is the cupola of the four-gun turret which is mounted on the upper surface of the fuselage just over the wing trailing edge. The power plant of the plane is a glycol-cooled Merlin III engine rated at 1,030 b.hp. at 3,000 r.p.m. at 16,500 ft., driving a constant speed, three-blade propeller of 11 ft. 6 in. diameter through a reduction gear of 0.477 ratio. A feature of this engine is the separation of its oil and glycol radiators. *Aviation*, September, 1942, pages 201, 297, 298, 3 illus.

Progress in Pictures. A group of pictures portrays the development of the Hurricane and Spitfire airplanes. Recent versions of these two planes are shown, as well as early models from which they evolved. *The Aeroplane*, August 7, 1942, pages 158, 159, 26 illus.

Features of the Do217E. Constructional details are presented of one of Germany's latest bomber types, the Dornier Do 217E, a high-wing monoplane with twin, underslung engines. This plane is a development of the Do 17Z, and exhibits no radical departure from conventional practice. It is pointed out that German practice favors the twin-engined type of bomber, with a medium bomb load, good range and fairly high performance, as distinct from the British four-engined bomber, which combines a much heavier load with comparable performance. Reasons for this preference are believed to be easier production and the shorter flight distances to objectives. The article covers general features of the plane including wing construction, fuselage and tail design, and the electrical equipment. *Aircraft Production*, August, 1942, pages 524, 525, 6 illus.; "Dornier Details," *The Aeroplane*, July 17, 1942, pages 70, 71, 6 illus.

Specifications on the Canadian Anson II Used as a Trainer Aircraft by the R.C.A.F. Dimensions, weights, specifications, structural and engineering details are given on the Canadian Anson II twin-engined trainer. The engines used are the Jacobs L-6MB and these are described fully, as well as their accessories. The structure and design of the airplane are then explained, each part and group of parts separately. Methods followed in the fabrication of the components and the

assembly of the airplane are clarified by photographs made in the various plants. *Commercial Aviation*, August, 1942, pages 44, 46, 48, 50, 53, 54, 15 illus.

Other articles particularize the contributions made by numerous Canadian firms that are producing Avro-Anson aircraft and parts and equipment therefore, as follows: "Massey-Harris Busily Engaged in Producing Wings for Canada's War Birds," pages 56, 58, 9 illus.; "Close Co-operation Between East and West Provides Scores of Anson Accessories," pages 60, 76, 2 illus.; "Building and Assembling Electrical Installations for Canada's Trainer Aircraft," page 62, 2 illus.; "Protection with Full Visibility," pages 64, 66, 7 illus.; "Western Plant Makes Fixed-Pitch Airscrews for the Canadian Anson," page 68, 2 illus.; "Socking the Difficult Anson Production Problem Right on the Nose," pages 70, 72, 9 illus.; "Fabricating and Assembling Engine Nacelles for the Canadian Anson," pages 74, 76, 5 illus.; "Multiple Control Unit for Fuel Cock, Carburetor Heat, and Oil Cooler, etc., Included in Anson II," page 78, 4 illus.; "Prenco Makes Couplings, Hoselines, and Magnesium Bearings for Canadian Anson," page 84, 1 illus.; "Bloctube Control Box on the Canadian Anson Represents Scientific Engineering Triumph," page 108, 2 illus.

Handley Page Halifax. Photographs are presented showing the Handley Page Halifax in operation. These are accompanied by detail sketches of the airplane. *Flight*, August 6, 1942, pages 146, 147, 9 illus.

Tezuitlan Primary Trainer. The Tezuitlan, a primary trainer designed in Mexico and built almost entirely of Mexican materials, is briefly described. Specifications and performance data are also listed. Made of mahogany plywood, a feature of the Tezuitlan's design is its split stabilizer, part of which is movable over a limited vertical arc to give adjustments necessary to meet the varying conditions of a mountainous country. *Aviation*, September, 1942, pages 227, 228, 6 illus.

The Searanger. Available information is presented in nontechnical language about the Navy's new Boeing type XPBB-1 long-range patrol bomber seaplane. Data are included on the construction and layout of the hull, crew accommodations, gun positions, wings and tail surfaces. The engines are understood to be the new 2,000-hp., 18-cylinder Wright type XR-3350, the installation of which is described along with information on the radio equipment and other accessories. Instructions are given for the construction of a model of the Boeing Sea Ranger. *Model Airplane News*, October, 1942, pages 21, 46, 48, 2 illus.

The Avro "Lancaster" Heavy Bomber. The first part of a detailed study of the design and construction of this recent addition to Great Britain's fleet of heavy bombers begins with a history of the development of the type. Its principal specifications are set forth, including tabulated data on the dimensions, engines, propellers and armament, followed by information on the construction methods used for each of the major components of the fuselage, wings, gun turrets and bombardier's section. Keynotes of the design are said to be ease of production, transport, and maintenance and repair. This article is based on a study made at the invitation of the Ministry of Aircraft Production. In the next installment the production of the airplane will be described. *The Engineer*, August 14, 1942, pages 129, 130, 1 illus.

Harlow PC-5A Basic Trainer. A description of the Harlow PC-5A includes specifications and performance data. This is a tandem, two-place all-metal basic trainer powered by a

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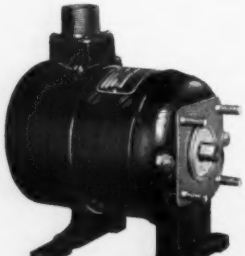

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Warner 165-hp. Super Scarab engine. It has a top speed of 163 m.p.h., a cruising speed of 145 m.p.h., sea-level climbing speed of 700 ft. per min., and a service ceiling of 16,000 ft. *Aviation*, September, 1942, page 231, 3 illus.

Which Ones Would You Blast? Drawings of American, German and Japanese airplanes reproduced through the courtesy of the *Range Finder*. They are accompanied by a brief description. *Western Flying*, August, 1942, pages 48, 49, 2 illus.

Focke-Wulf 190 Fighter. Based on an inspection of an airplane of this new type brought down in England, made with the cooperation of the Ministry of Aircraft Production, a study is presented of its design and performance. Dimensions and particulars are tabulated and comments are made on the general features of construction, armor, armament, controls and undercarriage. Details are given on the B.M.W. two-row, 14-cylinder, radial air-cooled engine, which is credited with contributing importantly to the performance of the plane. Aided by a construction drawing furnished by *Flight*, the features of the engine, propeller reduction gear and two-speed supercharger, as well as the cooling, lubrication and other points, are explained in considerable detail. The opinion is expressed that in general the airplane is a well-planned type of defensive fighter but is not an outstanding aircraft for offensive operations and that whatever merits it may have are more than countered in current British units. *The Engineer*, August 14, 1942, pages 137, 138, 4 illus.; "Focke-Wulf FW 190," *Canadian Air Cadet*, August, 1942, page 7, 3 illus.

Fairchild's Plastic Crew Trainer. The article describes the Fairchild AT-13 twin-engined crew trainer designed for training bombing crews as a unit. This aircraft is built almost entirely by the Duramold process, which provides a smooth exterior finish and is said to improve aerodynamic efficiency. The fuselage provides places for the bombardier in the transparent plastic nose, pilot and copilot in the cockpit, navigator-radio man beneath a special navigation hatch, machine gunner in a power-driven turret, and cameraman under vertical and angle camera hatches. Other features of design are covered. *Southern Flight*, August, 1942, page 33, 1 illus.

Airports

The Man in the Tower. Pvt. William Puder. Responsibilities and duties of the towermen at the Albuquerque Air Base call for young soldiers who have been thoroughly schooled as radio operators and technicians. The equipment of the traffic control tower is described and the routine pursued in the landing of a plane is followed. *Dixie Air News*, August, 1942, pages 20, 21, 2 illus.

Works Directorate. Ernest Holloway. Airport construction and maintenance are the responsibility of the British Works Directorate. The Director-General of Works of the Air Ministry validates the importance of its function and describes the conditions—often those of great odds—under which it works. Instances are given of airfields built under enemy fire with a minimum of equipment and materials on hand.

In depicting how the Works Directorate goes about its job of constructing airports, the necessity for selecting level acreage sites is stressed. The responsibility of the Directorate is summarized as providing the airdrome complete with all essential services. They purchase or hire the land, design the layout, and proceed with the construction. Runways, roadways, piers, slipways, water, electricity, drainage, sewage, cooking, heating, ventilating, petrol and oil storage, workshop machinery, and wireless masts—these needs partly indicate the range of activities which the department covers.

A brief discussion of camouflage as part of airdrome design is included in this article. *Flying and Popular Aviation*, September, 1942, pages 105, 106, 242, 252, 5 illus.

Armament

Rocket Bombs. A detailed explanation of rocket bombs launched from airplanes. The advantages of this form of attack are cited and the best methods of using it indicated. The writer states that they appear to possess great possibilities for use in attack against heavily armored ships, concrete gun emplacements and tanks because of a greater penetrating power and precision than ordinary bombs. In addition, at high levels an increased range is derived from added velocity. *The Aeroplane*, July 24, 1942, pages 108, 109, 2 illus.

Armament Production. J. W. Mills. The Director of Armament Production discusses the armament carried by the main types of British military planes. He indicates that superiority of weapons on both British fighters and bombers over those on German aircraft has been the deciding factor in many battles. The power-operated turret receives comment as do the kinds of guns used. *Flying and Popular Aviation*, September, 1942, pages 164–166, 6 illus.

Molded Ammunition Rollers. Carl Marquardt. As a part of the program for conserving strategic metals, the writer describes the manufacture and use of machine-gun cartridge belt rollers and ammunition boxes made of molded cellulose acetate butyrate. The engineering, production and assembly of these plastic rollers are described, with reference to their use in the Curtiss P-40 fighting airplanes.

The material was selected because it has properties meeting the requirements of the temperature range which is from −40° to 160°F. Tests conducted at the Curtiss-Wright materials laboratory, extracts from which are included in the article, show that this material can be successfully molded for difficult applications. The tests applied are described, including those for color, cementing quantity and effect of the temperature range. Service tests were also given to determine the suitability of the rollers at extremes of temperature to which they would be subjected in flight. Results of the tests are tabulated. *Modern Plastics*, August, 1942, pages 40, 41, 124, 126, 128, 130, 4 illus.

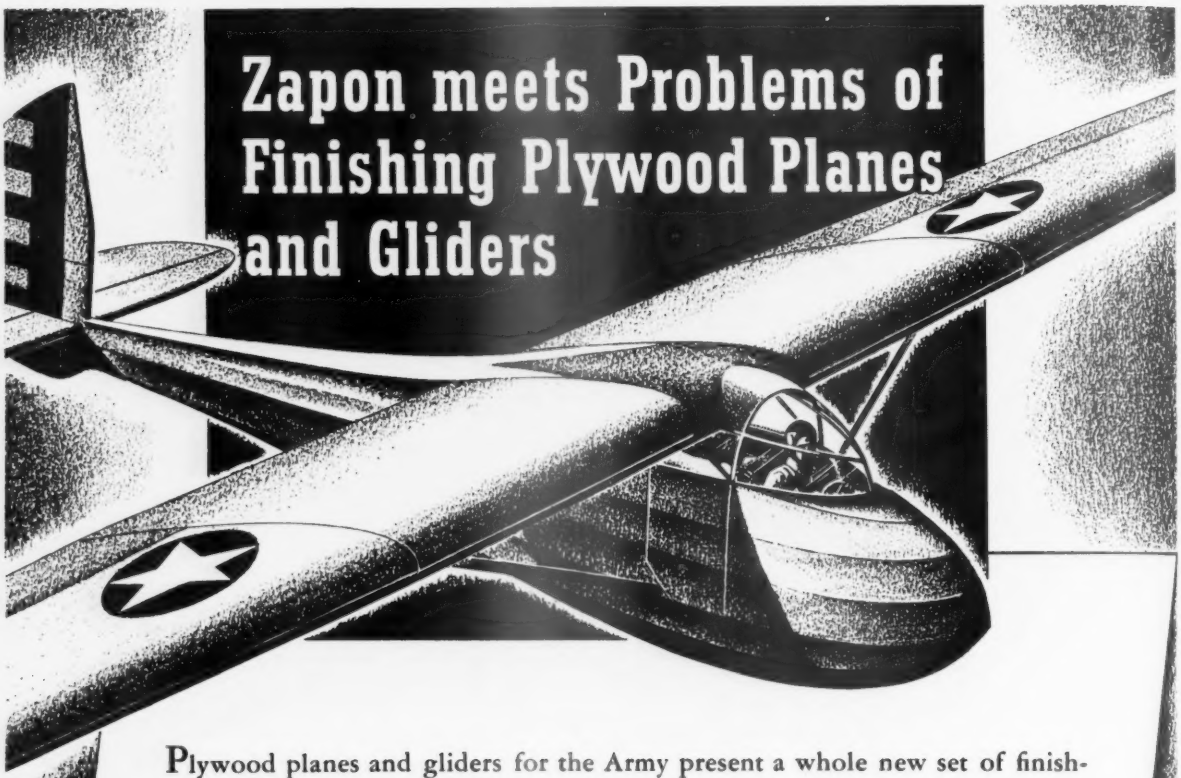
Avigation

Astro-Navigation. Lt. Col. A. L. Mieville. An approach is presented to the subject of celestial navigation which is offered as a reduction to its simplest terms of a study that has been regarded as complicated. The principles as set forth are the same as those upon which the usual mathematical methods are based, but the logarithms, formulas and difficulties are omitted.

Each step in the study is defined in simple language and explanations are given of the angles of altitude, the celestial sphere, latitude and longitude. The star globe is compared with the earth globe. Relations of longitude and time are established by visualizing the earth globe as rotating within the star globe. It is shown that an exact position can readily be found upon the surface of the earth by simplified methods, devices and calculations. *Flight*, July 23, 1942, pages 96–99, 6 illus.

Flying by the Stars. Joseph A. Ferris. This article tells of the manner in which Northwest Airlines, Inc., has adapted the principles of celestial navigation for the guidance of airliners over land routes. Because the customary system of radio beams, airport lights and other guides may have to be discontinued during blackouts or other wartime emergencies, the air-line company called upon a former naval officer and merchant marine master to work out a method of navigation for its pilots to enable them to determine their position while fly-

Zapon meets Problems of Finishing Plywood Planes and Gliders



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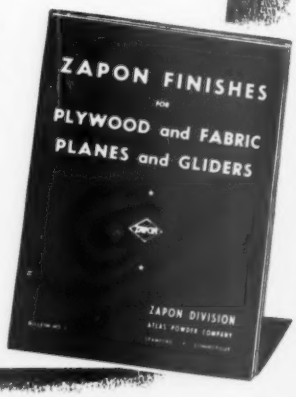

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ing without the aid of the usual peacetime direction finders. The system thus developed is described and a test of it is related. It is stated that celestial air navigation will speed air travel in the future. *Airlanes*, August, 1942, pages 8, 9, 19, 5 illus.

Astral Aircraft Navigation. This fourth article of a series deals with altitude observations. Development of facilities for the measurement of altitude has been rapid in recent years, it is pointed out. The construction of the bubble sextant is described and step-by-step details for operating it are furnished. Drawings clarify the presentation. *Canadian Aviation*, August, 1942, pages 47–51, 78, 11 illus.

Navigators in the Making. Herbert Asbury. The exacting duties of Army Air Force navigators and the intensive instruction they receive are described. The writer explains the vital importance of navigation, especially in long-distance bombing operations where accurate flight directions are essential to reaching an objective and fulfilling a mission. In the raid on Tokyo every bomber carried its own navigator who plotted the course to his particular objective, and every airplane reached the designated objective on time, according to an officer who piloted one of General Doolittle's bombers. Other achievements of Army Air Force navigators in the Pacific theater of the war are discussed. Illustrations show cadets in process of training. *Popular Science*, October, 1942, pages 114–119, 14 illus.

Business and Finance

Aeronautic Risk Exclusions Under Life and Accident Policies. George F. Killinger. The subject of this paper is introduced by an observation to the effect that there are probably three schools of thought followed by judges in dealing with exclusion clauses in life insurance policies concerning aeronautic risks. These are: (1) courts that distinguish between the facts of a particular case and those in cases of similar nature and which differentiate the law to be applied to the facts of the case; (2) courts that follow the doctrine that helps to establish rules of law whether good or bad; and (3) courts that, in reliance upon something like a sixth sense and accumulated knowledge, thus classify a case as permitting recovery or denying recovery. It is shown that much depends upon the interpretation of words used in framing the so-called exclusion clauses with reference to participation in aeronautical activities. Before proceeding to a discussion of cases the writer directs attention to statistics showing the ratio of accidents per mile traveled by air and by railroad. No attempt is made to review all of the authorities to date but a considerable number of cases are cited with explanations of the facts involved in actions to recover under insurance policies. *The Journal of Air Law and Commerce*, July, 1942, pages 228–251.

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

Airline Outlook Re-appraised. Selig Altschul. It is predicted that the commercial air lines will not only survive the uncertainties of the present but will soon be conducting a volume of operations far greater than in pre-war service. Reviewing the unfavorable factors prevailing in the spring of 1942, the writer traces the market movements of air-line stocks which have recovered at least 50 per cent from the lows of 1942 to the recent high marks. Tables show net equity and market valuations of five major air lines and the movement of average prices for 50 stocks representing aircraft and air transport companies.

A graph presents comparisons of net equity at the end of 1941, market value July 31, 1942 and market high for 1941, for American Airlines, Eastern Air Lines, Northwest Airlines, Transcontinental and Western Air, and United Air Lines.

Market conditions and recent decisions of the C.A.B. are reviewed and comments are made on rates and the profit outlook for the industry. *Aviation*, September, 1942, pages 198, 301, 302, 1 illus.

Civil Air Defense

Air Raid Defense. Col. George J. B. Fisher. An article discussing the role of military and civilian forces in aerial bombardment. It is shown that the Army's first training course in the technique of protection against air attack began a little over a year ago with a class of 50 students. The War Department is now conducting seven of these schools located in various parts of the United States. The writer discusses what these schools are teaching civilians. Proper training of civilians will minimize casualties and prevent disruption of productive war effort. *Army Ordnance*, September–October, 1942, pages 290–292.

Civil Aviation

The Sky's the Limit. Bill Green. With practically no new airplanes for sale and the difficulty in getting parts for those in use, it appears that private flying is disappearing, the writer states. It is suggested that the private owner enter the Civil Air Patrol and put his airplane on coastal patrol or courier service. The Civil Air Patrol needs more pilots and the work is interesting. Entrance requirements are outlined. Two-way radio equipment is required and the airplane must be in good mechanical condition. *Southern Flight*, August, 1942, pages 34, 35, 3 illus.

Civil Aviation. William P. Hildred. This is a report on the contributions of civil aviation to Britain's war effort. Naming the six companies now operating, it is stated that activities are based on the wartime policy of trying to enable civil air lines to continue as many essential services as possible while meeting the urgent air communication and transport needs of the Government. The obstacles that must be overcome are indicated and figures are quoted on the total mileage, passenger service, freight and mail transport, etc., that have been effected despite these difficulties. The article also tells something of the air planes that are being used for transport, training, and communications work. *Flying and Popular Aviation*, September, 1942, pages 174–176, 7 illus.

Companies

The Story of Federal Aircraft. William A. Hunter. The organization, operations and accomplishments of Federal Aircraft Limited are narrated. The company, which is owned by the Dominion government, was formed to produce war aircraft in Canada and to centralize the engineering and subcontracting work, as well as the purchasing of materials. Brief biographic sketches of the chief executives of the company are followed by a study of the production plans and methods adopted. *Commercial Aviation*, August, 1942, pages 40–43, 4 illus.

Ryan Celebrates 20th Birthday. A brief review is given of the development of Ryan Aeronautical Company. Among the accomplishments credited to the company by the writer are the inauguration of the first year-round scheduled passenger air-line service in this country; the building of planes for air-mail service; the surveying of

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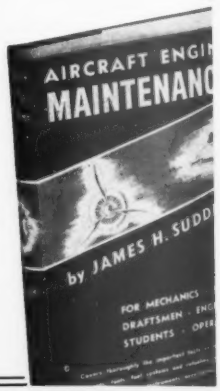

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the airway between Los Angeles, San Francisco, and Seattle; production of the series of planes which pioneered the low-wing monoplane trainers eventually adopted by the Army for primary instruction. *Aviation*, September, 1942, pages 104, 286, 289, 6 illus.; *Aero Digest*, September, 1942, pages 244, 249, 251, 252, 14 illus.

Design

Tricycle Landing Gear Design—Part 2. E. S. Jenkins and A. F. Donovan. In the second part of this paper, the problems related specifically to the design of the nose wheel are examined, and a basis for the selection of nose wheel and tire size is given. The fundamental causes of shimmy are reviewed, including the effects of trail, caster angle, wheel offset, tire type, and moment of inertia of castering parts. Shimmy elimination is discussed with special reference to elimination by damping and including methods of calculating the amount of damping necessary to prevent shimmy. The construction of fluid dampeners is described, and their damping characteristics are compared to the simpler mathematically defined types of damping. An empirical relationship between the volume of a vane-type hydraulic dampener necessary to prevent shimmy and the static nose wheel load is given.

Ground handling and maneuverability, construction and installation difficulties, castering locks and stops, and steering devices are briefly discussed. Conclusions as to the best arrangements must be based on the characteristics of the particular design. As a partial check on the validity of the criteria developed, the results of applying them to some successful tricycle gear airplanes are summarized. *Journal of the Aeronautical Sciences*, September, 1942, pages 397–410, 17 illus.

From the Ground Up. Sandy A. F. MacDonald. An air navigation instructor tells what the pilot should know about the components of the air frame and offers information on their structure, functions, limitations of strength, and resistance to deterioration. Common load and stress and other terms are defined, and conditions that affect the load factor are discussed. The pilot should realize that flight maneuvers impose high load factors. Other features discussed are the characteristics and requirements of a successful airplane and the properties of materials used in airplane construction. *Air Force Review*, August, 1942, pages 20, 21, 23, 28, 3 illus.

The B. V. 141. Richard Vogt. Translated from the German journal *Luftwissen*, this is a commentary by the designer of the B.V.141 on the advantages of asymmetric aircraft. He explains how the Blohm and Voss was evolved to fill certain specifications for a single-engined type airplane affording an especially good view. In addition to a description of the plane and the interpretation of the principles upon which it is based, comparative figures are tabulated on the B.V.141 and the contemporary-type English-built Lysander. *Flight*, July 16, 1942, pages 64–66, 4 illus.

The Cradle of the Fighters. Indicating the single-seater fighter airplane as the most important weapon of the war, this article traces its development from a 1913 version to the latest Spitfire and Hurricane models. The types that evolved through the intervening years are reviewed briefly in progression. Among those mentioned are the Sopwith Tabloid and Pup, the Bristol Scout, the Camel, the S.E.5, the Sopwith Snipe, the Gloster Grebe and Gamecock, the Armstrong Whitworth Siskin, and the Bristol Bulldog. Also noted are the Hawker Hornet, the Fury, the Gloster Gauntlet, the Hurricane, the Typhoon, and the Spitfire. *The Aeroplane*, August 7, 1942, page 160.

"Seal of Weight Approval" as a Means of Weight Control. Sidney Siggia. Aircraft weight classifications are defined and consideration is given to the problems of weight control. Certain design inconsistencies resulting in the use of material heavier than necessary for aircraft practice are attributed to the standards of equipment suppliers who were accustomed to working with industrial components wherein weight was not of such critical importance.

The "Seal of Weight Approval" award established by the Society of Aeronautical Weight Engineers is explained and further steps necessary to make the plan widely used and self-perpetuating are suggested. The program comprises seven major items with numerous subsidiary specifications, leading to the achievement of lighter weight for the aircraft itself in order that useful loads may be increased for the benefit of the war effort now and for more efficient air transport in the future. *Aero Digest*, September, 1942, pages 169, 170, 276, 278, 2 illus.

How Britain's Big Bombers Were Planned. This article relates how the British four-engined bomber was visualized at a conference held in the Air Ministry in May, 1936. The specification considered by the conference was known as B12–36. Calling for certain range, bomb load, wing span, speed, armament, etc., plus the vital feature of buoyancy, it resulted in modern bombers such as the Stirling, Halifax, and Lancaster. *Flight*, July 23, 1942, page 85.

The Future of Water-Based Airplanes. Capt. Frank T. Courtney. The fourth in a series of articles on flying boat design, this deals with the methods of eliminating the principal design features held to be responsible for the inferiorities of water planes. The points he covers are the elimination of excess body height, the elimination of excess body width, and deadrise. His conclusion is that a transversely flat planing bottom is the only logical and efficient type. *Aviation*, September, 1942, pages 116–119, 285, 286, 6 illus.

Our Warplanes Grow Stronger. Carl Dreher. The writer first gives a general view of airplane design and then considers some specific features with special reference to current design. It is pointed out that streamlining is used inside of airplanes as well as outside. Heat generated by the engine must be led away by air that enters the airplane at one point and leaves at another. Streamlining of this cooling system is important. The Republic P-47 Thunderbolt, one of the fastest high-altitude fighters, is an example of an aircraft that was practically built around the cooling system to obtain internal streamlining.

It is also necessary to discriminate between standardization in the sense of interchangeability and standardization in the sense of freezing design, the writer states. The first is both possible and beneficial, while the second is impossible in the course of modern war. From the aerodynamic standpoint a good index of engine efficiency is the weight per horsepower, and both in-line and radial engines weighing a little more than 1 lb. per hp., and sometimes less than 1 lb., are being built. The present trend is toward more powerful engines. For cargo conveying, larger airplanes are needed. Ton-mile cost varies in inverse proportion to the size of the airplane. Larger airplanes necessitate more powerful engines and this brings up propeller problems which are discussed. *Popular Science*, October, 1942, pages 82–89, 223, 224, 226, 14 illus.

Fighter Take-Off Weight. W. Nichols. Estimation of the weights of component parts of an airplane of new design and of the ultimate take-off weight is a difficult engineering problem. The writer offers a method whereby at the inception of a new design a rapid estimate can be made. The article deals entirely with the fighter type of aircraft. Estimations are accomplished by means of a chart compiled from data of existing aircraft, which gives average weight dis-

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tribution as a percentage of take-off weight for class A fighter aircraft, and certain curves. Practical applications are discussed. *Flight*, July 30, 1942, pages 126, 127, 3 illus.

Flying Wing to Revolutionize Air Transport. E. J. Foley. Reviewing the aerodynamic advantages credited to the Northrop Flying Wing type of construction, the writer predicts that this design will cause a radical change in air transportation in the next few years. Secondary design features are explored which may complement the general utility of the Flying Wing. For one such feature, there is projected a three-part wing, typical of box-spar construction, consisting of a leading-edge section, a center section between the box shear webs, and a trailing-edge section. Theoretic and practical consideration is given briefly to the use of the center section for load carrying, permitting considerable lightening of the structure. Installation of engines in the trailing-edge section, using five or more units aggregating horsepower running into the tens of thousands, is visualized. Questions of engine accessibility and removal are raised and suggestions are made for portable mounts. Further detailed consideration is given to efficient methods for utilizing the center section for loading and removing cargo, and ideas are advanced for passenger accommodations in the leading-edge and center sections of large aircraft of this type. *American Aviation*, August 15, 1942, pages 34, 44, 46, 2 illus.

Engines

The BMW 801 Motor. Construction drawings of this engine show the cowling and cooling details, the nose lip controllable gill, and the trailing-edge controllable cowl slot. *The Aeroplane*, July 31, 1942, page 135, 4 illus.

Cyclone Combustion. A review is presented of an industrial motion-picture film produced for Wright Aeronautical Corporation. The film, which runs for 25 min., illustrates what happens in the engine combustion chamber under varying conditions of operation. Using both motion-picture photography and animated drawings, the film portrays the causes and effects of proper and improper combustion in a cylinder of a Wright Cyclone 14 aircraft engine. Synchronized with the pictures are technical comments recorded on the sound track. Detonation is emphasized and numerous other aspects of combustion and other technical details are covered. Instructions are included for handling engine controls so as to secure proper operation. *Commercial*

Aviation, August, 1942, pages 132, 134, 1 illus.

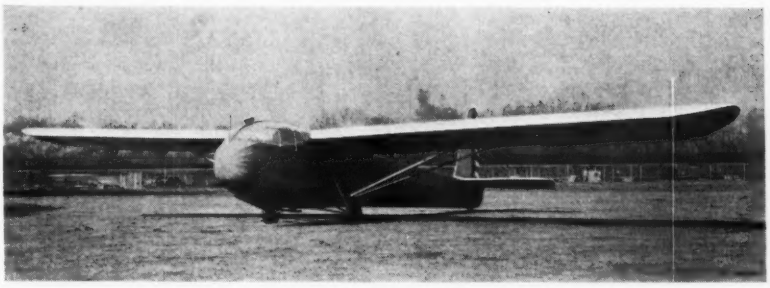
Aircraft Engine Testing. Attention is drawn to the fact that in America working schemes have been evolved for conserving and utilizing the power running to waste in engine testing, though doubts have been expressed as to the practicability of such schemes. Because with absorption dynamometers of the water-brake type power is dissipated to heat in the water and lost, attention has been turned to regenerative electric dynamometers. It is announced that the scheme has been brought to working form by the English Electric Company in England and that this company is reported to be in production on such apparatus. Details of the system are described with the aid of a diagrammatic layout. *Aircraft Production*, August, 1942, pages 484, 485, 1 illus.

Japan's Power Units. Haruo Yoshikawa. Originally appearing in the German periodical *Luftwissen*, this article reviews the development of Japanese aircraft engines prior to the war. Brief details are given on several engines which were Nipponese versions of foreign engines. Type 90 and the Kinsei engines are among native Japanese types described at somewhat greater length. *Flight*, July 16, 1942, pages 70–72, 4 illus.

Engine Production. F. R. Banks. This article tells how wartime requirements are being met by the expansion of Britain's major airplane engine firms. Design and production problems are discussed. It also tells how three of the principal companies—Bristol, Rolls-Royce, and Napier—are being augmented by shadow factories.

In conclusion, some brief information is presented about the engines manufactured. Those mentioned are the Rolls-Royce Merlin, the Bristol Pegasus and Mercury, and the Napier Sabre. *Flying and Popular Aviation*, September, 1942, pages 162, 163, 236, 240, 242, 6 illus.

Manufacturing the Rolls-Royce Merlin XX—Part II. J. A. Oates. This is the second article in a series and covers the machining of the crankcases and cylinder blocks, exhaust-valve details, gear manufacture, and assembly. In the erection department an efficient line system is used whereby the unit subassembly lines feed into the main track. For subassembly purposes a similar system, incorporating elevated rail tracks with turntables leading to sidings, is provided. Photographs of these systems are furnished together with illustrations of the research and test departments. Other illustrations show the crankcase, seven-bearing crankshaft, completed single-piece cylinder block, and various machining operations. Drawings show tooling layouts, cutter arrangements and the sodium-filled exhaust valve design. *Aircraft Production*, August, 1942, pages 486–497, 38 illus.



The Waco troop or cargo-carrying nine-place glider built entirely of nonstrategic materials.

Steam in the Air. V. L. Gruberg. Early attempts to use steam power in aircraft are outlined by the writer, who then continues with a review of progress during the past 20 years. Discussing later developments, the writer describes in some detail several steam propelling plants. One of these was built by the Bureau of Engineering of the United States Navy Department soon after the last war and showed considerable promise. Other steam power plants described are the Besler, with a coil tube boiler fired by fuel oil; the Sulzer single tube steam generator; the Bechard, a rotary boiler type; and a power plant of 2,300 hp. developed by an American aircraft company in collaboration with the General Electric Company for use in large flying boats. The latter was provided with a La Mout type steam boiler.

The problems and possibilities of employing steam power for aircraft are considered. Attention is called to the report of the National Advisory Committee for Aeronautics after an investigation on steam propulsion for aircraft. It showed that considerations of weight, economy, and resistance of the cooling surface precluded the use of a steam power plant. In view of the trend toward powerful power plants, however, the writer believes the verdict should not be taken as final. The demands for more power may open new vistas for the employment of steam. *Flight*, July 30, 1942, pages 115–118, 7 illus.

Flight Technique

Torque Be the Enemy? William D. Strohmeier. An explanation of torque and its effect upon various flight maneuvers. Among the maneuvers studied are the Chandelle, Lazy 8, Pylon 8, stall, loop, and snap rolls. The relation of torque to an airplane's "left-handedness" is discussed and indication is given that torque becomes more important as horsepower increases and wing span decreases. *Air Facts*, September, 1942, pages 26–32.

Determination of Wind Velocity in Flight. Al. Santilli. The writer explains a simple method for a pilot to determine the wind velocity and direction. The pilot is required to fly two straight courses, one directly into the wind between two landmarks and the second straight downwind over the same two landmarks and to take the time each way. Then a simple formula, which can be worked out without paper, will give the wind speed after a solution inspection. The only equipment required is a stopwatch or ordinary watch with large sweep second hand and a reliable speed indicator. A slide rule is optional. *Soaring*, May–June, 1942, page 3.

The Working Speeds of the Airplane. Wolfgang Langewiesche. An article intended to furnish pilots with an understanding of the theory of flight with special reference to airplane working speeds. Sections cover the speed of best distance, the speed of best duration, maneuvering speed, the limit of cruising economy, the speed of fastest climb, and the speed of steepest climb. Two diagrams aid in the presentation. *Air Facts*, September, 1942, pages 39–53, 2 illus.

Gliding and Soaring

Gliders for War! Capt. H. O. Johansen. Observations are reported from a recent tour of centers of glider activity, indicating that such craft are taking an important place in the nation's war plans. Giving the inherent advantages of glider trains for the rapid movement of troops and supplies, the writer traces the progress that has been made in the training of glider crews at numerous centers of the Army Air Forces, in the methods of launching gliders, and in the systems for picking up gliders from the

ground and releasing them for landing. *Model Airplane News*, October, 1942, pages 6, 7, 63, 64, 8 illus.

Gliders Joining the Fight. The tactical possibilities of gliders are indicated by a brief study of the expansion of the United States glider forces, the number of gliders now being made, and the nature of the training being given to glider personnel. In addition to combat missions, it is stated that the glider program is providing for the contemplated mass movement of troops and heavy cargo.

The article offers a comparison of the gliders being manufactured by the United States with those used by Germany. It mentions airplane companies building gliders and comments upon the fact that because of the nature of their construction and the materials used gliders lend themselves to a considerable amount of subcontracting production. *Aviation*, September, 1942, pages 101, 309, 310, 313, 3 illus.; "Development of Our Army's Glider Forces," Col. D. H. Schlatter, *Aero Digest*, September, 1942, pages 101, 102, 105, 8 illus.

Gliding to Victory. Richard Merrifield. The writer points out the change of attitude with regard to the importance of gliders as an adjunct to our air forces. He discusses the magnitude of the glider-building and training program now under way. It is stated that Germany realized the value of gliders for military use long ago and began building them when the Versailles Treaty banned power-operated airplanes. The preparation showed results at Crete. The future of the glider is discussed and the opportunities glider training schools offer for young men unable to qualify as aviation cadets is indicated. *Western Flying*, August, 1942, pages 32, 33, 82, 4 illus.

Ships for Our Air Commandos. Gliders for warfare and the men being trained to operate them are described. A glider capable of carrying nine fully equipped soldiers has been developed by the Army Air Forces to aid in training troops for attacking the enemy behind his own lines. One of the novel features of this glider is that it will come to earth on skids, the wheel gear being dropped as soon as it leaves the ground. Another development is the transforming of training planes into gliders by removal of the engine and the installation of a special nose piece. Illustrations of gliders and the men who operate them are furnished. *Popular Science*, October, 1942, pages 70–72, 7 illus.

British Glider Training. A description of the Hotspur II, British glider now being produced in quantity, is presented in conjunction with a brief account of the training being given to Royal Air Force glider pilots. Dimensions of the Hotspur are noted, as is the fact that its landing gear incorporates a combination of twin wheels and a skid. *Aviation*, September, 1942, page 203.

"Too Low and Too Slow." Comdr. Ralph S. Barnaby. About a month after its delivery to the Navy in 1941, a two-place soaring glider operated by an experienced Naval pilot crashed on a field at Philadelphia. According to the pilot, after completing the last turn prior to landing, the glider refused to respond to the controls and dropped its nose in landing. Later it was disclosed that all men who flew that glider had similar experiences. In all but the above case, however, altitude was sufficient for recovery. The writer of the article believes that this crash and certain others mentioned were the result of attempting a highly banked turn at too slow a speed. The reason, in his opinion, that even experienced pilots have such trouble is due to lack of definition and determination of what is too slow a speed. Further factors are discussed and possible means of preventing such crashes are suggested. *Soaring*, May–June, 1942, page 4, 1 illus.

Instruments

"Eyes in the Dark." V. A. Pope. Functions and operations of aircraft instruments in general use are explained in nontechnical language. Among the instruments studied are the air-speed indicator, turn and bank indicator, altimeter, vertical speed indicator, directional gyro and gyro horizon. The fundamental principles upon which each instrument operates are set forth, as well as the methods by which they are applied. *Canadian Air Cadet*, August, 1942, pages 14, 15, 8 illus.

Some Fallacies About the Magnetic Compass. H. Herbert Howe. Misunderstandings about the fundamentals of the action of the earth upon the compass are said to extend beyond the range of laymen to groups even including authors of textbooks and articles on air navigation. The first fallacy is that the compass points toward the magnetic pole and in the relationship of that idea to the common explanations of declination. It is shown why such concepts are erroneous and that the compass is in fact controlled by the integrated effect of all parts of the earth rather than any specific point.

The second fallacy is the belief that the secular change of the earth's magnetism is due to motion of the magnetic pole, a hypothesis connected with the first fallacy. The secular change is explained. The third fallacy is the supposition that secular changes of the magnetic declination can be predicted. By quoting an example, the writer demonstrates that prediction is uncertain. In summing up, the theory of earth magnetism is explained and it is stated that observations to determine the rate of secular change must be continued indefinitely. *Aero Digest*, September, 1942, pages 84–86, 380, 5 illus.

The Technique of Aircraft Bubble Octant Observation in Flight. Judson H. Ingram. The sensible horizon is defined and its representation by the bubble in the aircraft octant is explained, along with forces that influence the bubble when in flight. Consideration is given to the errors arising from these forces, of which one is the turn error, caused by the action of the automatic pilot in correcting for the centripetal force imparted by the aircraft in flight. Acceleration error is another factor that is explained. Examples are given of proper methods of taking observations. The Coriolis law is defined and instructions are given for applying it in the determination of position. *Aero Digest*, September, 1942, pages 125, 126, 4 illus.

Jet Propulsion

Jet and Rocket Aerial Propulsion. G. W. Walton. The writer explains the difference between rocket and jet devices used in aerial propulsion. By common usage the term rocket is applied to any missile that propels itself by the relatively slow burning of pyrotechnical substances and the ejection of products of combustion in rearward direction, while a jet device is supplied with a fluid under pressure which issues as a common jet and is usually employed to accelerate a second fluid. It is further explained that the rocket carries its own supply of oxygen for combustion and can be operated in a vacuum, whereas a jet device for aerial propulsion uses oxygen from the atmosphere and cannot operate in a vacuum. Speaking historically, it is pointed out that the classic steam engine of Hero was an early example of jet propulsion.

As an aid to understanding practical forms of jet propulsion, several existing devices now in common use, which are not propulsion devices, are described. One of these is the Penberthy steam injector, which is entirely automatic.

The essential parts of a modern form of rocket engine also are described with the aid of a diagram. As a means of propelling airplanes, the

The B.F. Goodrich Airplane of the month
BELL AIRACOBRA
BOLT OUT OF THE BLUE! It's the famed Bell Airacobra, a clean, swift "Cannon on Wings" that packs the wallop of a 37 mm. anti-tank cannon in its nose, and 30 cal. and 50 cal. machine guns in its wings. For months Airacobras have been in the fight, furthering our cause, doing our nation proud. New planes are streaming off the Bell lines by the hundreds. And many B. F. Goodrich products, including the famous Airplane Silvertown Tires, are helping to "Keep 'em Flying." This month, B. F. Goodrich salutes the Bell Airacobra, a great plane, with a great record of service in many a combat!
The Army flies with
B.F.Goodrich
FIRST IN RUBBER

B.F. GOODRICH RUBBER RESEARCH FOR THE *Aviation industry*

Conductive tail wheel tread "grounds" static electricity

AS MENTIONED in a previous article, static electricity is generated by a plane in flight. When a plane lands, its three points of contact are the tires, which, when made of ordinary rubber, act as insulators.

Thus, the static electricity is not discharged and can cause the annoyance of shock to passengers or crew. Furthermore, there is a chance of the electrical discharge causing a spark during refueling.

To overcome this situation, B. F. Goodrich set out to develop a tail wheel which would conduct static electricity off a plane as soon as it touched the ground.

Carbon black, being a good conductor, was experimented with. The carbon black content of tail wheel treads was increased. But the solution of the problem was not an easy one. For, by increasing the carbon black content of the tread and thus stepping up its conductivity, tests showed that the tread wore badly and flex-cracked.

New and better types of carbon black were developed that made it possible for B. F. Goodrich engineers to produce a tread which had all the desired qualities of durability and, at the same time, acted as a conductor. Now B. F. Goodrich Tail Wheel Tires in use are electrical conductors. When a plane uses these tail wheels, the static electricity leaks off upon contact with the ground. This special conductive tread offers advantages for military as well as commercial aircraft. The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.

LET'S GO! U.S.A. · KEEP 'EM FLYING!

MAKERS OF B. F. GOODRICH TIRES AND OVER 80 RUBBER AND SYNTHETIC RUBBER PRODUCTS FOR AIRPLANES

ELECTRICALLY CONDUCTIVE TAIL WHEELS

made by B. F. Goodrich

CONDUCTIVITY IN A TAIL WHEEL TIRE is indicated by a simple test. Voltage is applied to an electric light bulb in series with two contacts on the tire. The relative conductivity of the tire will be shown by the intensity of the light produced.

WHEN THIS LOCKHEED-HUDSON MEDIUM BOMBER makes a landing, its B. F. Goodrich Tail Wheel Tire comes into contact with the earth. This tire dispels the electrostatic charge which has built up on the plane during flight.

In war or peace

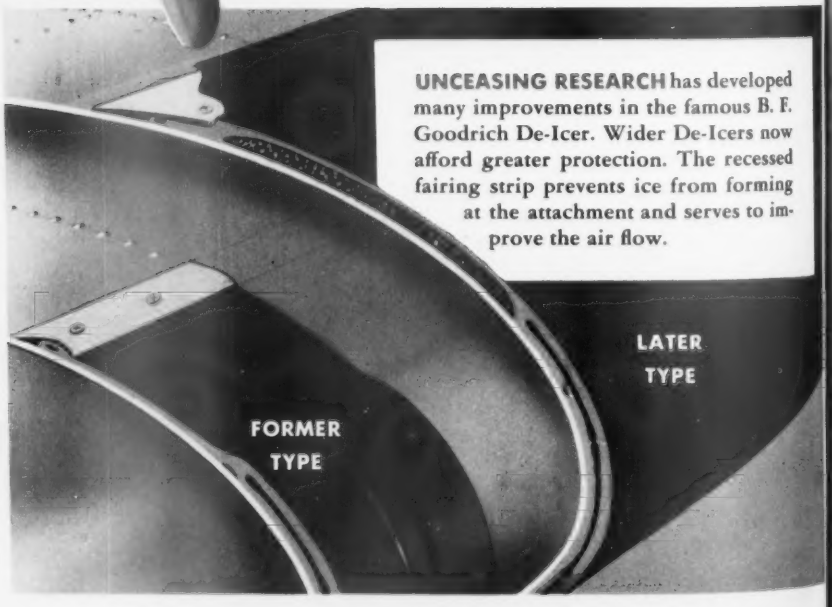
B.F.Goodrich

FIRST IN RUBBER

From the B. F. Goodrich Notebook

PRODUCTS THAT "defy the elements" are one of the most important contributions to aviation made by the B. F. Goodrich Aeronautical Division. Here you see a Feed Shoe being inspected on a typical three-bladed propeller. This rubber product makes it possible to bathe the whirling blades of a propeller with protective anti-icing fluid.

RIVNUTS, the B. F. Goodrich hollow rivet which can be upset from one side, can now be installed at greatly increased speed with a newly developed power tool. Write for the new handbook which has just been issued for designers and engineers.



UNCEASING RESEARCH has developed many improvements in the famous B. F. Goodrich De-Icer. Wider De-Icers now afford greater protection. The recessed fairing strip prevents ice from forming at the attachment and serves to improve the air flow.

B.F.GOODRICH - AERONAUTICAL DIVISION - AKRON, OH

rocket in its present form is held to be not very efficient. *Aeronautics*, August, 1942, pages 48–50, 2 illus.

Prevention of Rocket Motor Burn-Out. Cedric Giles. Methods of overcoming the tendency of rocket motors to burn out are studied. It is stated that this is the principal obstacle to the success of the liquid-fuel rocket motor and that none of the usual means for counteracting this fault has been entirely satisfactory. Materials entering into the construction and various methods of cooling are discussed. Causes of burning are analyzed and two methods are reviewed for preventing burnout. The first is by surrounding the liquid oxygen with a thin layer of fuel and the second is the principle of "outside burning." The writer believes that by using concentric feed and employing outside burning the major impediment to successful rocket motors can be overcome. *Flight*, August 6, 1942, pages 155, 156.

Lighter-Than-Air

Balloon Command. Leslie Gossage. The British Air Officer Commanding, Balloon Defense, explains the purpose of the command, tells something of its general operating control, and gives a brief sketch of the history of balloon defense with particular reference to its application in Great Britain. He shows how balloon barrages are used for the protection of vulnerable areas. They are not expected to destroy enemy aircraft but rather to drive them to a height from which accurate bombing is difficult. The cessation of German major attacks on balloon barrages is pointed to as proof of the effectiveness of this type of defense. Comment is also made on the fact that W.A.A.F. crews are now manning balloon sites. *Flying and Popular Aviation*, September, 1942, pages 97–100, 216, 220, 222, 8 illus.

Maintenance

Salute to Ground Crew! In this article the writer stresses the importance and discusses the duties of a ground crew of the Royal Canadian Air Force. The members of the ground crew take as much interest in the planes as the men who fly them, it is found. Illustrations show members of the ground crew in the active performance of various duties. *Air Force Review*, August, 1942, pages 4, 5, 13, 5 illus.

This Huge Business of Overhaul. The system of subcontracting the work of overhauling and repairing the aircraft used in Canada for instruction and operational use is outlined. The work is being done in shops all over the country, most of which were built or financed by the government, although they are privately operated. Tabulations show the types of engines and aircraft being handled and the list of instruments on which similar work is performed. A partial list of the companies that are contributing to this system includes only the larger units, but the total amounts to several score. Supervised by the repair and overhaul division of the Department of Munitions and Supply, orders which originate in the R.C.A.F. are routed through to the shops best fitted to undertake the work, and officers of the division maintained contact with the contractors. *Canadian Aviation*, August, 1942, pages 31–33, 40, 6 illus.

Maintenance of American Aircraft with the R.A.F. M. W. Bourdon. A description of a repair and maintenance depot established in England, composed of men specializing in the upkeep of American aircraft. How this depot was built up is described. Starting with a staff of only 16 men as the nucleus, it has been expanded until it now has some thousands of employees of whom 95 per cent were originally unskilled or only semi-skilled workers. It was found that expansion was too gradual to meet the urgent demand for men with full knowledge of American aircraft, some of which must be in the ground staff of every operational unit where American aircraft might be stationed. The requirement was met by organizing a separate school of maintenance specializing in American aircraft. Details of this school and the courses of instruction covered are given. *Automotive and Aviation Industries*, August 15, 1942, pages 19, 80, 3 illus.

Low Temperature Bearing Lubrication. A group of seven pictures portrays the equipment designed and built by the Pacific Railway Equipment Company for large-scale degreasing and relubricating of antifriction bearings. Accompanying captions explain the purposes and operations of each machine. *Aviation*, September, 1942, pages 135, 138, 7 illus.

Salvage. C. W. Weedon. The Director of Repair and Maintenance tells how the R.A.F. Maintenance Group salvages crashed aircraft. He cites the importance of the work both as a source of materials and—in the case of enemy airplanes—as an aid to research and development. Special equipment for this purpose, evolved since the beginning of the war, is noted. This includes a mobile crane capable of operating under all conditions, a Long Low Loader known as the "Queen Mary," trestles used in conjunction with the "Queen Mary," and jacks for lifting crashed airplanes. *Flying and Popular Aviation*, September, 1942, pages 170, 171, 6 illus.

Maintenance Means Safety. Hubert G. Lesley. Aircraft of Eastern Air Lines operated under contract for the Army receive the same meticulous care and service work as planes that carry commercial passengers on regular runs. How the maintenance schedules and inspection operations have been applied to the cargo planes now in Army service is related by the company's superintendent of maintenance. Some of the inspection forms and operating schedules of the maintenance department are reproduced. *Airlanes*, August, 1942, pages 10, 11, 16, 18, 6 illus.

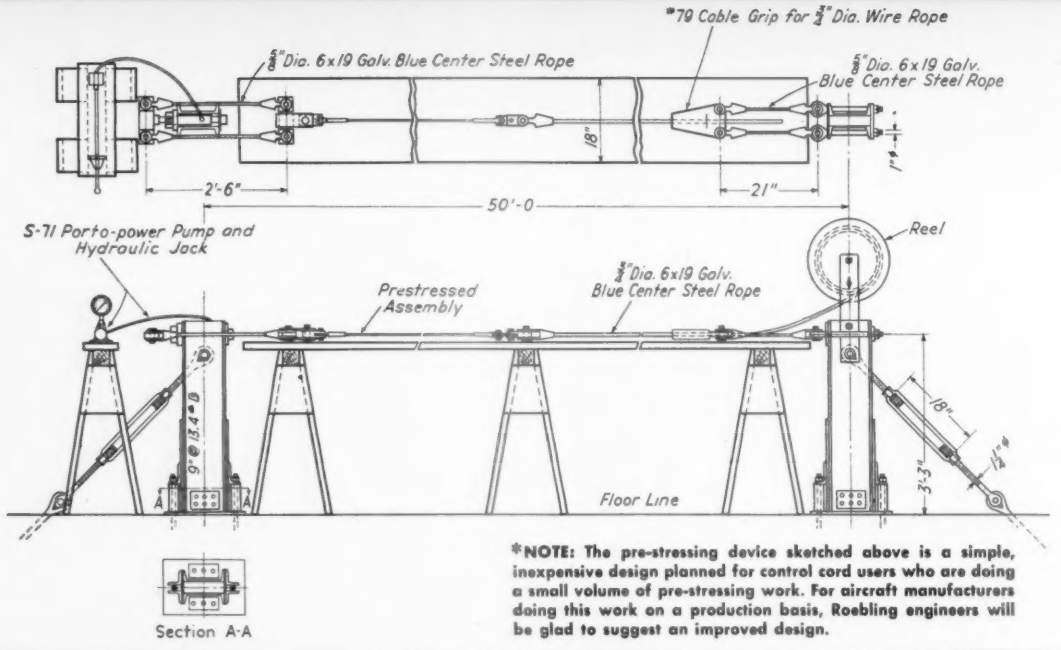
Maintenance at Continental. Stanley R. Shatto and L. Wettengel. A description of Continental Air Lines' new overhaul base at Denver is supplemented by details on some of the maintenance equipment in use there. The building—a combination office building and hangar—is jointly occupied by Continental and United Air Lines and incorporates practically all modern features to facilitate the maintenance and repair of airliners. Engine overhaul, propeller overhaul and instrument checks are particularized. The article also deals with the type of equipment in use at Continental's small service bases, the qualifications of its maintenance employees, and the routes covered by this air line. *Aviation*, September, 1942, pages 205, 207, 209, 283, 10 illus.

Maintenance Command. John Bradley. The problems of the R.A.F. Maintenance Command are discussed by its Air Officer Commanding-in-Chief. The work of this Command covers the entire range of service, linking industry with operational flying, and designed to meet sudden needs as well as routine requirements. Its many different duties are divided between four specialist groups and two independent wings. One wing controls the packing organization for all the aircraft that are to be shipped overseas; the other is the Mechanical Transport Wing which administers the specialized mechanical Transport (truck) companies. *Flying and Popular Aviation*, September, 1942, pages 101, 270, 277, 1 illus.

Management

Bonus Systems. C. R. Nortcliffe. Introduction of a workers' bonus system is suggested as one of the best means for achieving full use of productive capacity. Three alternative methods are offered from which to choose: (1) individual bonus (piece-part), where each operator is dependent solely upon his own efforts for obtaining additional earnings; (2)

1 IF YOU DON'T USE COMPLETE ASSEMBLIES OF CORD AND SWAGED FITTINGS, YOU MAY USE THIS DEVICE*...OR



***NOTE: The pre-stressing device sketched above is a simple, inexpensive design planned for control cord users who are doing a small volume of pre-stressing work. For aircraft manufacturers doing this work on a production basis, Roebling engineers will be glad to suggest an improved design.**

TWO METHODS OF ELIMINATING

CONSTRUCTIONAL STRETCH

FROM AIRCRAFT CONTROL CORDS

ON THIS and the facing page are shown two solutions to the ever-present problem of constructional stretch in aircraft cord. For two reasons, aircraft engineers have been conscious for some time of the desirability of eliminating it. The first and most obvious reason, of course, is the fact that a certain amount of stretch occurs in the cord after it is installed, necessitating further adjustment after a few hours in the air. Second, cord which is not pre-stressed tends to rotate, which in turn tends to change the adjustment of turnbuckles in the assembly.

Pan-American Airways System, who worked with Roebling engineers for the solution of this problem, are well satisfied with the results shown above. The device represented by the drawing was designed to be installed in the Pan-American shops, and used on all cord before installation in the Clippers. Of simple design, the device utilizes a bench made of wood, the length and detail of which depend upon the shop location available and the maximum length of assemblies to be handled. At one end of the bench, a structural steel column anchor carries a hydraulic jack. At the other end, a similar column carries a storage reel for the tag rope and also a means of anchoring the tag rope. The hydraulic jack, of conventional type, has a travel of 6 inches.

The jack is equipped with a hand pump and gauge so that the desired tension can be applied and recorded by the gauge. With suitable auxiliary parts, this device may be used to pre-stress either complete assemblies with swaged fittings, assemblies with simple splices at both ends, or a cord with one free end and a simple splice at the other.

Also indicated is a tag rope, with open socket attached to the end, to which one end of the cord assembly is fastened. The tag rope is connected to the anchor column by means of a quick-acting wedge clamp. By a simple wedging action, this clamp enables the tag rope to be adjusted to the length necessary to accommodate the aircraft cord being pre-stressed. Excess tag line is kept wound on the storage reel.

In the interest of Victory, Roebling and Pan-American make this information available to all manufacturers and operators of aircraft to whom it may be of service.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY Branches and Warehouses in Principal Cities

ROEBLING
AIRCRAFT WIRES

2 YOU MAY PURCHASE COMPLETE PRE-STRESSED ASSEMBLIES FROM ROEBLING

FOR those manufacturers prepared to use aircraft cord assemblies complete with swaged fittings, Roebling can supply the assemblies, pre-stressed at the factory to remove the major part of the constructional stretch.

Theoretically, such factory pre-stressing does not result in the final removal of as high a percentage of constructional stretch as that done immediately before the cord assembly is installed in the aircraft. The reason is, of course, that when the pre-stressed assemblies are coiled for shipment, the cord tends to recover a small amount of the stretch. But for practical purposes, factory pre-stressing of complete assemblies will be found adequate for the majority of installations.

Can the

ROEBLING DEVELOPMENT LABORATORIES

Help Solve Your Problem?

For generations, wire rope research and development has been the byword at Trenton. Here you will find facilities for almost every type of test you care to make . . . fatigue tests, dissection and studies of used cords, metallurgical research, stretch characteristics, temperature changes and their effects. Roebling engineers, with years of knowledge of aircraft cord, will place these facilities at your disposal and co-operate with you to the fullest.

JR ROEBLING

AND FITTINGS

group bonus (subassembly), which may be applied where sections or groups of workers are engaged on erecting or subassembly, or where operations require two or more operatives working together as a unit; (3) collective bonus (finished product), which may be installed where it is decided to pay bonus on a given output of finished articles resulting from the combined efforts of the entire factory personnel. Factors that require consideration in the selection of the most appropriate system are discussed and features of the systems are described. Cards used in connection with the systems are illustrated. *Aircraft Production*, August, 1942, pages 498–500, 3 illus.

The Foreman and Industrial Relations. H. D. Farren and G. A. F. Brannon. A discussion of the problems in human relationships which confront foremen in the aircraft industry and how they can be successfully solved. In addition to a thorough technical knowledge of his work, the characteristic traits stressed as necessary for a foreman to make a true leader are loyalty, courteousness, cheerfulness, frankness, fairness and friendliness.

An outline is presented on the work and purpose of the War Production Board's "Job Instructor Training," a course now being taken by thousands of aircraft foremen. This provides for planned conferences held every week in cycles of six to eight months. At a 90-minute table discussion, planned by a conference leader, ideas are exchanged on foremanship technique, training, the effective handling of men, materials and equipment, and other pertinent questions. *Aero Digest*, September, 1942, pages 129, 266, 268.

United's Suggestion Conference. Fred A. Denz. Details are presented on the organized suggestion plan in operation for the past ten years at United Air Lines. How employees submit work-improvement and time-saving ideas, the monetary rewards they receive, and the results obtained with these suggestions are reviewed. *Aviation*, September, 1942, pages 213, 215, 289, 3 illus.

Production Dividends from Employee Suggestion Systems. Russell Newcomb. A survey of aviation companies conducting successful employee suggestion systems is reported. The systems were found to have six basic points in common; these are defined and discussed. The experience of the companies interviewed indicates that a well-conducted suggestion system will pay large returns. Illustrations aid in the presentation. *Wings*, August, 1942, pages 83–86, 5 illus.

Industrial Relations—The Human Equation in Industry. A. M. Rochlen. The Director of Industrial and Public Relations at Douglas Aircraft interprets the factors that contribute to a successful industrial-relations program and shows how these are employed to the best advantage at Douglas. He also explains the connection between industrial and public relations.

The department is separated into several divisions: employee publications, industrial education, shop displays, special events, industrial research; government coordination; radio and motion pictures; photographic, press contacts, and speakers' bureau. The responsibilities of each of these divisions are described. Comment is also made upon the employee training and educational program, shop suggestions system, employee welfare activities, material-conservation program, employee athletics and recreation, industrial safety, housing and transportation, and the system of personnel counselors stationed in the shop to guide and advise employees. *Aero Digest*, September, 1942, pages 138, 255, 256, 297, 298, 8 illus.

Calendar for a Seven-Day Work Week. A work calendar to keep each man advised as to when he is scheduled to work is being used by the Pratt & Whitney Aircraft Division of the United Aircraft Corporation. This calendar was issued when the company changed over from the six- to the seven-day work week. The calendar, which is of pocket size, is described and illustrated. *Wings*, August, 1942, pages 92, 93, 1 illus.

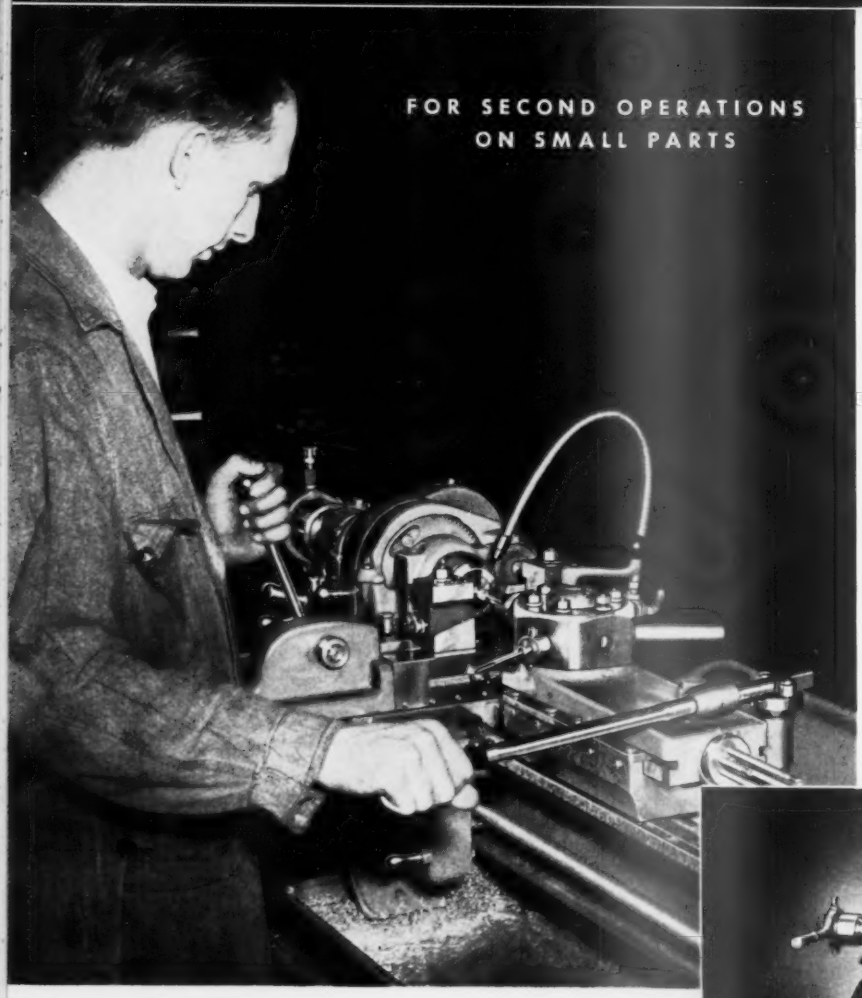
Materials

Metal Construction of Twenty Years Ago. A study of the Silver Streak, presented by its designer Oswald Short in 1920. This airplane was the product of pioneer work in the field of stressed-skin metal construction. In addition to describing the structure of the Short Silver Streak, the article relates the rather apathetic attitude which greeted its debut. *Flight*, July 16, 1942, pages 67–69, 6 illus.

Medicine

The First Flight Surgeon. Robert J. Hunter. Duties of the Flight Surgeon are defined by the writer. One of these is watching the flying personnel for evidence of deterioration. Men must be constantly re-examined. It is stated that the flight surgeon should be supported in the field by at least three or four specialists, such as men who specialize in eye, cardiovascular and respiratory diseases. Examinations in wartime should be more frequent. Basic medical examining units must be carefully organized.

New SOUTH BEND TURRET LATHES



Designed for the rapid machining of small duplicate parts, the new Series 1000 South Bend Turret Lathes are especially adaptable to second operation work. Their speed, accuracy and versatility make possible rapid production without sacrificing efficiency or precision.

Features that contribute to the versatility and efficiency of these lathes are the smoothly operating handlever bed turret, the handlever cross slide with double tool blocks, the compound cross slide with power longitudinal feeds and power cross feeds for the universal carriage, forty-eight precision thread cutting feeds driven by a lead screw, and a wide range of spindle speeds.

The handlever bed turret indexes automatically on the return stroke and is equipped with an adjustable feed stop for each face. The handlever cross slide has adjustable stops for both the front and back tool blocks. Standard extras simplify tooling this lathe for war production and make it easily convertible to other work when peace comes.

Series 1000 Turret Lathes

The Series 1000 Turret Lathes have a 1⅜" spindle hole, 10⅛" swing over bed, and 1" maximum collet capacity. They are made in bench and floor types—with or without coolant equipment. Standard equipment includes quick change gear box, power feed universal carriage, handlever cross slide, compound rest cross slide, and handlever bed turret. Standard extras (not included in prices of lathes) include 4-way turret tool block, tailstock, collet attachment, taper attachment, thread dial indicator, and micrometer carriage stop. Write for Bulletins 1002 and 1004 which contain complete information and specifications.

SOUTH BEND LATHE WORKS

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Lathe Builders for 35 Years

A brief review of events between March and June, 1918, tells of the establishment of the rank of Flight Surgeon in the Air Service Signal Corps. Three officers were detailed as such, of whom the writer was the first to report for duty, thus becoming the first Flight Surgeon in any military or civil organization. *The Military Surgeon*, September, 1942, pages 349–353.

Aviation Medicine. Harold E. Whittingham. Written by the Director General of the Royal Air Force Medical Services, this is a study of the aviation medicine problems facing the Royal Air Force, together with a brief survey of how they are being solved. Consideration is given to the promotion of airmen's physiologic efficiency during high-speed aerobatics, high altitude, and under high-pressure fighting conditions. Information is also presented on the tests that determine the selection of men for flying and other duties on a medical basis. *Flying and Popular Aviation*, September, 1942, pages 149, 150, 188, 190, 196, 6 illus.

In Re the Army Flight Surgeons. With a Major at the Santa Ana Army Air Base as a prototype, the qualifications for a Flight Surgeon, his training, and the work he does are outlined. His six weeks of training at the Army School of Aviation Medicine is concentrated on courses on opthamology, study of the physiologic effects of flying conditions, and neuropsychiatry. When his full status of Flight Surgeon has been conferred, he is charged with the care and treatment of the hospitalized and flying personnel. He consults with the Commanding Officer on sanitation, facilities, medical supplies, equipment and maintenance and assumes responsibilities as selector, examiner, and arbiter of those who are fit to be members of the United States Army Air Forces and to which branch each shall be assigned. The article also follows in detail the two-day physical examination given by the Flight Surgeon to air cadet applicants. *The Sportsman Pilot*, August 15, 1942, pages 12, 13, 36, 38, 5 illus.

Metallurgy

Discussion of the Effect of Minor Alloying Elements on Aluminum Casting Alloys. W. Bonsack. An article based on exhaustive work by the National Smelting Company, of interest to technologists concerned with aluminum alloy die casting and foundry problems. Aluminum and its alloys, like most all commercial metals, contain metallic and nonmetallic elements that are expensive to remove. These are classed as impurities, though it is not always known whether they are

harmful or useful. The writer deals with the question of how many and of what amounts of these minor elements can be present without adversely affecting the properties of aluminum alloys.

The discussion indicates that with certain exceptions the effect of the minor alloying elements on the mechanical properties of aluminum-copper, aluminum-copper-silicon, and aluminum-copper-nickel alloys is either beneficial or harmless. The only element that requires rigid control is magnesium, but iron contamination arising through the foundry process must also be watched carefully. All the other elements such as manganese, titanium with nickel, chromium, and cobalt in one group and tin, lead, antimony, bismuth and cadmium in another group are usually present in small enough amounts so that there is no harm. Appended to the article is an extensive bibliography together with references covered during the investigation. *A.S.T.M. Bulletin*, August, 1942, pages 45–59.

Rust-Proofing of Ferrous Metals. H. Silman. A continuation of a previous article on rustproofing. In this installment the writer deals with acid pickling, the effects of annealing, hot tinning and organic coatings. Cadmium-plated aircraft engine components are illustrated, and a semiautomatic pickling plant for small components is shown. *Sheet Metal Industries*, August, 1942, pages 1173–1180, 5 illus.

New Aero (NE) Steels Devised to Expedite Production and Conserve Scarce Alloys. Tables are presented of conventional and tentative alternate steel specifications as recommended to the War Production Board by the Technical Advisory Committee on Aeronautical Steels. The committee was formed as a part of the National Emergency Steel Specifications project, which has the objective of standardizing the production of steel products.

The first table represents selections intended to cover practically all the various aircraft requirements. The second table is a tentative selection of alternate steels that could be used to replace the conventional alloy steels to meet the needs for conservation of critical alloying elements. These substitute steels are termed National Emergency Aeronautical Steels and have entirely new compositions. *S.A.E. Journal*, September, 1942, pages 18–20.

Season Cracking of the Aluminium-Base Mg-Al Alloys. Translated by H. J. Cant. This article is based on a translation from *Nippon Kinzohu Gakkai-Si*, October, 1940, and is one of a series. Alloys of the Mg-Al system are used in the airplane industry because of their tenacity, weldability and anticorrosion properties. Close attention has been paid recently to their use as material for surface layers in compounded sheets of strong light alloys and as welded products. It has been found, however, that with alloys of this system season cracking occurs when they are left in sea water for some time. The article covers the results of research on the cause of this phenomenon. Subjects covered include the occurrence of season cracking, the relation between season cracking and crystalline structure, composition and season cracking, and the relation between season cracking and heat-treatment. *Sheet Metal Industries*, August, 1942, pages 1181–1184, 11 illus.

A Comparative Study of the Processes of Bronze-Welding and Brazing. E. Christie. In order to draw a comparison between bronze welding and brazing, both processes are described in considerable detail. While bronze welding and brazing are akin to each other, there are distinct differences in the two processes at certain points. These points are so intermingled, however, that they cause confusion, it is stated. Both processes rely on the adhesive power of the joining metal for strength, though more reliance is placed on this feature in bronze welding. Copper-zinc alloys are used as bonding metals in both processes, although the composition of the alloy may be varied to meet special requirements. With either process similar or dissimilar metals may be joined. Bronze welding requires a definite manipulative technique involving the use of a directly applied, highly concentrated heating flame, together with a rod of closely controlled chemical composition. In this respect the process is related to oxyacetylene welding. The brazing process permits a variation in the composition and form or shape of the joining material, and a variation is allowable in the type of heating medium employed provided heat is not directly concentrated on the brazing alloy. In bronze welding the pieces to be joined must be both cleaned and vee'd when the metal thickness ex-

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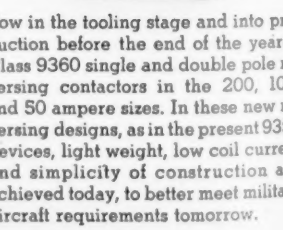

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ceeds 1/8 in. Positional deposition may be completed in a manner similar to oxyacetylene welding. In brazing, vee'ing is neither necessary nor desirable, and positional deposition is impracticable for general-purpose productive operations. One application of bronze welding is to the fabrication of certain types of light-gauge steel aircraft fittings. *Sheet Metal Industries*, August, 1942, pages 1199–1205, 17 illus.

Meteorology

An Instrument for Computing Altitudes in Upper Air Soundings. Lt. N. E. Johnson, Jr., Lt. L. A. Kiley, Jr., and D. P. Keily. A mechanical device is described for computing altitudes in the process of evaluating a meteorologic sounding of the atmosphere by the use of an airplane or radiometeorograph. The device is of convenient size and is said to give results equal in accuracy and superior in speed to either the tabular or graphic methods or any of the usual combinations of these methods. Since the computation of these altitudes generally consumes a large part of the time required for the entire evaluation, the factor of speed becomes one of the major advantages of the instrument. Another point is that it provides a continuous reading of the altitudes at successive levels of the sounding.

The construction of the instrument is detailed. A summary of the results obtained gives a comparison with results found by the use of Bjerknes tables. Variations are attributed to imperfections in engraving the scale, and further improvement could be secured by more careful design of other parts, according to the writers. A suggested application of this device is for an automatic height computer to be operated directly by a radiosonde recorder. *The Bulletin of the American Meteorological Society*, May, 1942, pages 191–195, 1 illus.

War Weathermen. Pvt. Wm. H. Puder. This article describes the duties of some 20 of the air force men who are engaged night and day at the bombardier training school at Albuquerque, N.M., getting and compiling weather reports to aid in the efficient operation of the school. *Western Flying*, August, 1942, pages 56, 62, 86, 7 illus.

Military Aviation

Policy Makers and Bombing Effort. Navator. The effectiveness of the British bombing effort is discussed by the writer and the question is raised whether the applied bombing policy is satisfactory. Discussing recent mass air raids, the writer states that the one on Cologne in which 1,000 aircraft took part was the greatest of this war up to June of this year and, according to reports, an outstanding success. Damage done in the Essen raid where a similar number of aircraft were used is yet undetermined, but the writer views as significant the fact that the same target had to be revisited almost immediately. The probable lack of success undoubtedly was largely due to a thick industrial haze combined with the fact that Essen has no striking landmark to distinguish it. Repeated visits were necessary at Rostock, but results at Lubeck were better. The perfect raid of the present type was on the Renault works. Here the target was large and weather excellent. The writer continues with an examination of the reasons why pinpoint targets are practically immune under present bombing methods. *Aeronautics*, August, 1942, pages 28, 29.

Torpedo Aircraft. M. Waddell. The writer discusses the functions of torpedo-carrying aircraft and compares the carrier-borne and land-based types. An examination of the data for ship-borne torpedo carriers of all nations indicates that no nation has produced a ship-borne torpedo carrier with a performance to compare favorably with that of shore-based aircraft, it is stated. Reasons for the inferiority of carrier-borne aircraft are given. It is believed that this type will drop further behind in the race to install heavier armor and more and better armament. *Flight*, July 30, 1942, page 121.

Briefing Comes First. S. L. M. Hallem. An outline is presented of the organization and plans by which the Royal Air Force is enabled to carry out its bombing missions. The first step in a bombing operation is the visit of the crew to the operations room where the men are "briefed"; this consists of a thorough explanation of the work to be accomplished. They are told of the appearance of the target, the landmarks near it, the route to be followed, the defenses likely to be encountered, the tactics to be employed, the bomb loads to be carried, the weather conditions and other data. With this information, they prepare their maps and courses and complete all other details so that the flight can be made with precision. A detailed report is submitted upon the return. *Canadian Air Cadet*, August, 1942, page 21.

Analysing Soviet Air Strategy. An attempt is made in a brief article to evaluate the strategy of the Russian air force. Calling attention to the fact that Russian air activity to date has been largely confined to close cooperation with the armies on the western front, using fighter aircraft to harass the enemy's communication lines, the opinion is expressed that the Soviet Government is reserving its heavy bomber strength for defensive operations against possible Japanese attacks from the east. It is also possible that offensive operations are contemplated against the Japanese, in which event, long-range, four-engined bombers would be needed to reach Japanese cities and factories. Confirmation of the belief of the writer that Russian aircraft production is being concentrated on heavy bombers is found in the statement that aircraft supplied to the Russians by Britain and the United States have consisted primarily of fighter planes. Credit is given to the Soviet strategy as being at least as good as that of the other United Nations. *The Motor in Australia and Flying*, May, 1942, page 19.

Signals and Radio. C. W. Nutting. A consideration of the problems facing the Signals Division of the Royal Air Force as explained by the Director of Signals. The central organization and planning of Signals is the responsibility of an Air Ministry directorate, which is part of the department of the Chief of the Air Staff. The staff of the Director General and Inspector of Signals keeps intimately in touch with operational requirements and the application of signals technique to plans for future operations. Methods employed by the Signals Organization are radio transmitters and receivers, telephone and teleprinter circuits, visual signalling apparatus, dispatch riders, special carriers and pigeons.

The article also includes a commentary on the use, development, and extension of radiolocation which comprises a large proportion of the total signals effort. Although the precise method of applying radiolocation to the interception of aircraft cannot be revealed, the underlying principle is explained. *Flying and Popular Aviation*, September, 1942, pages 138–140, 8 illus.

Air Defence of India. A press conference is reported with Air Marshall Sir Richard Peirse, recently appointed Air Officer Commanding-in-Chief for India, in which he outlines plans for the defense of India and of an offensive campaign based on that country. American and British aircraft and

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pilots used in the defense of the Dutch East Indies and in other actions in the Pacific are praised. Although Japanese aircraft and their pilots have shown themselves to be better than expected, confidence is expressed that the forces of the United Nations will be able to overcome them. It is stated that the Indian Air Forces is fairly well equipped but that additional equipment coming from Britain and the United States will be helpful in forthcoming actions. It is indicated that for the contemplated attacks directly on Japan, bases in China or Russia are likely to be used. An explanation is given of the reasons for the fall of the Dutch East Indies and Malaya, lack of equipment being considered the primary factor. *Indian Aviation*, March, 1942, pages 74–76.

Mustang Squadron. A comparison is drawn between a Royal Air Force army cooperation reconnaissance squadron as seen by the writer 28 years ago and again today. When first visited, the pilots flew B.E. planes with a top speed of 75 m.p.h. Now they are flying high-speed North American Mustangs. The landing speed of the Mustang is 90 to 100 m.p.h., or 25 m.p.h. faster than the top speed of the B.E. type. Duties of an army cooperation reconnaissance pilot and features of the airplanes he flies are discussed. *Flight*, July 30, 1942, pages 122, 123, 4 illus.

The "Madras" Halifax Bomber Squadron. Achievements of the "Madras" squadron of the Royal Air Force are recalled in a narrative of the actions in which that unit has been engaged. Among the attacks carried out by the squadron were those on Berlin, Karlsruhe, Essen, Dusseldorf, Duisburg, Frankfurt, Wilhelmshaven, Mannheim, Nuremberg, and Achen. The squadron participated in an attack on the German battleships "Scharnhorst," "Gneisenau," and "Prinz Eugen." It is credited with the destruction of 21 enemy fighters and severe damage to others. *Indian Aviation*, March, 1942, pages 76, 77.

Naval Aviation

An Expert Looks at Naval Warfare. Paul Schubert. Changes made in naval warfare are studied in the light of the addition of air power to the gun-fighting and torpedo power of the navies. The effectiveness of aerial bombing against surface ships is assessed in the cases of the evacuations of Norway, Dunkerque and Crete. It is shown that in those actions ships were able to attain their objectives in the face of aerial bombing superiority and that although losses of ships were heavy they were bearable.

The sea-bombing picture is briefly reviewed under three headings which bring out that in the long run the percentage of hits is small, that misses at sea are nearly a total loss whereas on land some damage is done, and that bombs are less effective against large ships than against small ones. The value of air reconnaissance is proved in such cases as the destruction of the "Bismarck," although the final blows were delivered by naval guns and ship-launched torpedoes. Aerial torpedoes are held to be a most potent weapon, especially when launched by large numbers of airplanes attacking from so many different angles that anti-aircraft fire becomes ineffective. The advantages and disadvantages of aircraft carriers are set forth, with the conclusion that they have worked out differently in practice than in theory. The secret of carrier operations is held to be the use of sufficient numbers of them in each action. Their primary function is said to be as floating fuel depots and service stations. The movement of a battle fleet into action is traced, from the reconnaissance planes to the heavy battleships and torpedo planes. *The Saturday Evening Post*, August 15, 1942, pages 19, 84–86, 1 illus.

Navy Dive and Torpedo Bombers. Naval bombing is a precise procedure as far as aiming is concerned, but dive and torpedo bombing must be performed by aiming the airplane at the target and shooting "by eye," the writer explains. Both of these methods of bombing have been criticized and now have been tested in actual warfare. Dive bombing remains the most debatable tactic. The argument against the dive bomber has been that it could be rendered impotent by fighter planes. This is a defensive point of view, however. With fighter protection the dive bomber is a devastating offensive weapon, it is stated. At sea, in particular, it is said to possess a deadly effectiveness against warships. *Western Flying*, August, 1942, pages 46, 47, 7 illus.

Republic P-47 Thunderbolts on a portion of the Republic Aviation Corporation's final assembly line.

Parachutes

Ripcord Warriors of the Marine Corps. Lt. Gordon Hagberg. Marines are being taught parachute warfare at Camp Gillespie, the new Marine Parachute Training School attached to the Marine Corps Base at San Diego, Calif. Details of the training course, which lasts six weeks, are enumerated. During the first two weeks the men learn how to pack a parachute and to jump from a dummy airplane. Then they are taught to jump from 250-ft. towers. During the last two weeks the Para-Marines are taught to make parachute jumps from flying airplanes. The nature of the equipment carried is outlined. In addition to the recently added submachine guns, they also carry hand grenades, ammunition, concentrated food and water. Cargo parachutes are used for landing heavier pieces including antitank guns, trench mortars, and heavy machine guns. *Southern Flight*, August, 1942, pages 22, 23, 4 illus.

Personalities

Santos-Dumont, Air Pioneer. M. Lowndes. A brief biographic sketch is interwoven with details of his aeronautical accomplishments since 1898. Called the father of flight, Santos-Dumont began his sponsorship of aviation with balloon experiments. It is claimed that the modern monoplane is directly descended from one of his early twentieth century models and that the present state of airmind-

edness owes much to his efforts to "sell" aviation to the public. Although it is stated that he foresaw the possibility of aircraft as a martial weapon, he believed that the greatest function of air vehicles was transportation of passengers, mail and freight. *Air Facts*, September, 1942, pages 54–61.

Controller is Ralph Bell's New Title and Powers. The additional duties of Canada's Director of Aircraft Production, Ralph P. Bell, are outlined. Mr. Bell has been appointed Aircraft Controller in the Department of Munitions and Supply. The appointment gives him authority to deal with subcontractors, whereas formerly, he had authority only over the activities of prime contractors. By reason of his position, Mr. Bell will be a member of the Wartime Industries Control Board. He will have jurisdiction over all production facilities for the making of aircraft, aircraft parts and gliders. *Canadian Aviation*, August, 1942, pages 39, 40, 1 illus.

Personnel

Dominions Squadrons. Short descriptions of the formation and activities of the squadrons from the dominions of the British Empire now fighting with the Royal Air Force. Among the territories noted are Canada, Newfoundland, New Zealand, Australia, South Africa and Rhodesia. *Flying and Popular Aviation*, September, 1942, pages 142–144, 8 illus.

Eagle Squadrons. An account of the three Royal Air Force Fighter Command squadrons composed of United States flyers includes mention of some of the prominent pilots, as well as the enemy toll taken by these units. The first squadron completed its training in May, 1941, and has been taking regular part in daylight attacks on occupied France ever since. It is reported to have shot down nearly 40 enemy aircraft. The second Eagle Squadron is credited with having destroyed seven enemy aircraft on offensives over the Continent, while the third is said to have destroyed five German fighters. *Flying and Popular Aviation*, September, 1942, pages 145, 274, 2 illus.

Allied Air Forces. A. S. W. Dore. The Allied Air Forces, composed of airmen from conquered nations who now fly with the Royal Air Force, are lauded for their courage and heroism. Individual cases are cited about how various Poles, Norwegians, Dutchmen, Belgians, Free French, Czechs, Greeks and Yugoslavs escaped to Britain to continue the fight against their common enemy.

Comment is made upon the characteristics of each nationality which tend to make them good fighters. In conclusion, the article questions whether the nucleus for a postwar international police force does not lie among this group of men. *Flying and Popular Aviation*, September, 1942, pages 146–148, 273, 8 illus.

Women's Auxiliary Air Force. K. J. Trefusis Forbes. What women are doing and how they are doing it in the assumption of Royal Air Force auxiliary duties to release men for active combat duty is revealed by the Director of the W.A.A.F. She states that at the present over fifty "trades" are staffed by W.A.A.F. members. They are active in the radio-location and signals trades such as wireless and radio operation, radio mechanics, etc. There are also a number of technicians, trained by the R.A.F. in skilled and semiskilled maintenance jobs—armorers, electricians, flight mechanics, sparkplug testers and instrument repairers. Another group of duties is of a scientific nature such as meteorologist, photographer, cine-projectionist, and tracer; there are such domestic jobs as cook, tailor, hairdresser and orderly; a clerical group includes clerks both general and specialist, bomb plotters and equipment assistants. In the medical class are found dental clerks, dispensers, mas-

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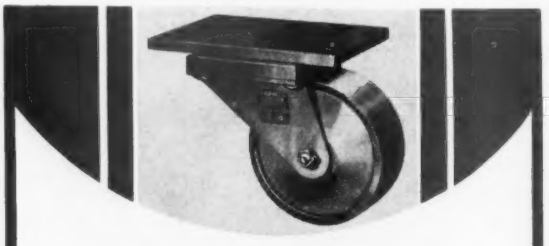
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The article covers the development of the Women's Auxiliary Air Force from a small nucleus to a point where substitution of W.A.A.F. personnel for R.A.F. is taking place on an ever growing scale. *Flying and Popular Aviation*, September, 1942, pages 127–129, 254, 14 illus.

The Man in Action. Flight Lt. H. E. Bates. This article is devoted to a discussion of the traits characterizing British airmen. In a series of portraits depicting the heroic actions of various Royal Air Force members it shows how bravery, unselfishness and modesty contribute toward making the Royal Air Force one of the greatest in the world. Of particular interest is a comparison of the characteristics that distinguish the fighter pilot from the bomber pilot. *Flying and Popular Aviation*, September, 1942, pages 130–133, 223, 225, 230, 9 illus.

Photography

Photographic Equipment in the Royal Air Force. The writer describes the camera equipment now being used by the Royal Air Force and indicates the special lines along which progress has been made. Methods have been devised for reducing the responsibility of the operator, who now is an airman rather than an experienced photographer. The electrically operated camera can be set before the flight so that all the pilot has to do is to set it in motion when he is ready to take photographs. The basic instrument of the R.A.F. is the F.24 general purpose camera, which can be used for vertical overlaps, oblique overlaps or as a handheld camera. Improvements have reduced the time for changing the film, taking the picture and resetting the shutter from 5 to 2 sec. The magazine of the latest camera contains film for 250 exposures as opposed to 125 for earlier cameras. Other camera features are described in considerable detail with the aid of photographs, and a table showing the chief characteristics of the more important R.A.F. cameras is furnished. *Aeronautics*, August, 1942, pages 30–34, 6 illus.

Photography. Capt. F. C. V. Laws. Written by the Deputy Director of Photography, this is a study of aerial photography as it is used by the Royal Air Force to obtain accurate information regarding the enemy as clearly and as quickly as possible. The development of air photography is chronicled briefly and comment is made upon the important problem of recruiting and training air force photographers, while a description of R.A.F. camera equipment is presented.

Taking the F.24 camera as an example, it is stated that British aircraft cameras are built on the unit system with a basis of six units. These are: the body, the focal plane shutter, the gearbox, the lens and cone, the magazine, and the camera mounting. *Flying and Popular Aviation*, September, 1942, pages 134–137, 272, 8 illus.

Plants

Putting Blinders on the Axis. This article describes briefly how industrial camouflage hampers accurate bombing raids. It is based on the *Industrial Camouflage Manual*, a report on the work of the industrial camouflage program at Pratt Institute. *Popular Science*, October, 1942, pages 90–95, 12 illus.

Plastics and Plywood

Plastics Face the Critics. John S. Trevor. The purpose of this article is to examine the premises of recent criticisms of plastics and arrive at an appreciation of their usefulness for aircraft construction.

First looking on the negative side of the plastic situation, the writer gives reasons why thermoplastics are not suitable for large stressed units. In part, these have to do with the specific strength, mechanical properties, creep and cold flow, a fatigue limit and possible distortion.

It is emphasized that the criticism refers to inherent weaknesses and is not a general condemnation of thermoplastics for all stressed units. Thermoplastics are quite suitable for small units under stress. Plastics most suitable for large, highly stressed aircraft units are mentioned. Continuing with the discussion, the writer states that the best material for highly stressed units is improved wood, sometimes known as high density, superpressed or resin impregnated wood, though some early claims regarding it were exaggerated. *Aeronautics*, August, 1942, pages 36, 37, 1 illus.

Glue in Modern Aircraft. While most bombers and fighters are made largely of metal, wood is used extensively in many aircraft including certain trainers. The gluing of wood aircraft structures is discussed. A comparison is drawn between the gluing of wood and the welding of steel aircraft parts. The characteristics of casein glue and urea and phenolic resins are discussed. Techniques of glue application in aircraft production are set forth. *Canadian Aviation*, August, 1942, pages 55–58, 80, 84, 4 illus.

Tooling for Plastic-Bonded Aircraft. William D. Lewis. This article, abstracted from a paper read at an S.A.E. meeting in Los Angeles, states that if plastic-bonded plywood were used extensively for the construction of aircraft in the United States production facilities could be nearly doubled by entrusting furniture and allied woodworking industries with the fabrication of parts. Such work would have to be under the supervision of established aircraft manufacturers. It is claimed that no new buildings or metal-working machinery would be required and that there would be no need for time-consuming training courses for employees. The writer stresses the similarity between production processes used for plastic-bonded plywood and all-metal airplanes. The fabrication of flap and surface controls, vertical stabilizers and the fuselage also is discussed. *Automotive and Aviation Industries*, August 15, 1942, pages 32–34, 68, 70, 5 illus.

Wing Tips of Synthetic Material. The article describes a new application of Pytram to aircraft construction. Pytram is a synthetic material consisting of cellulose laminations impregnated with resin adhesives. Components difficult to manufacture in sheet metal can be made of Pytram with a saving in both cost and weight, it is stated. Tests of a wing tip made of this material are discussed, and a loading test is illustrated. A table showing the properties of Pytram, which originally was produced for the manufacture of unstressed and lightly stressed parts, is furnished. *Aircraft Production*, August, 1942, page 483, 1 illus.

Tokyo and Return. H. M. Richardson. A new application of plastics was in the use of the material for the loop antenna housing on the North American B-25 flown by General Doolittle in his raid on Tokyo. The development of this new application for plastics is described in some detail and the process of manufacture is shown. *Modern Plastics*, August, 1942, pages 42, 43, 134, 136, 7 illus.

Technical Skill Assures Adequate Supplies of Plywood for Canadian Aircraft Manufacture. Facilities of Dominion Plywoods, Ltd., for the production of plywood aircraft parts are described. After listing the new equipment recently installed, the layout of the plant is reviewed briefly and the various steps in the manufacture of plywood components are followed. It is said that this company is operating at capacity on war orders. *Commercial Aviation*, August, 1942, pages 80, 82, 10 illus.

Plastics in Aircraft Tooling. A review of developments at the Lock

After ten months of all-out war, Consolidated Liberators have emerged as among the most versatile bombers in the world. Whether pounding the Axis with their destructive might or ferrying men and materials across the seven seas, these B-24's range far and wide to carry the fight to the enemy.

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heed and Vega plants in the United States where drill jigs and forming dies made almost entirely of plastics are being produced. Disadvantages of drill and jig construction using wood with inserted metal bushings are pointed out and the advantages of the plastic method as now developed, one of which is a saving in time, are discussed. The research work that was necessary to bring the plastic method to its present state of perfection is described in considerable detail. Some of the manufacturing operations and specimens of plastic drill jigs and forming dies are illustrated. *Aircraft Production*, August, 1942, pages 502–507, 15 illus.

Airplane Pilot Seats. To provide one of the most desired factors for pilots on long-range, high-speed aircraft—that is, a comfortable place to sit—the plastics industry has applied itself to the construction of airplane seats. Improvements in the adhesives available have made it possible to use bonded plywood and other plastic materials in place of metal for these seats, which constitute one of the latest components of an airplane to be converted to plastic construction. Government specifications for such materials for training planes are presented. It is shown that several manufacturers of aircraft parts have developed constructions that meet these specifications. The completed seats and the materials used by various manufacturers are described. It is stated that tests demonstrate that the strength-to-weight ratio of these plastic-bonded airplane seats are comparable to metal and they have other advantages indicating continued use after the war. *Modern Plastics*, August, 1942, pages 48, 49, 118, 5 illus.

Engineering in Wood. James E. Thompson. This is the second of a series of articles on plywood. The writer takes up manufacturing methods, hot-setting resin glues, the application of plywood skins, finishing wood parts, and tools and equipment in this installment. *Western Flying*, August, 1942, pages 68, 70, 72, 2 illus.

Parachute Flare Base. Experiments have been made with various materials for the manufacture of the base block which functions as a container for the parachute flare mechanism. A laminated plywood parachute flare base has been developed which is reported to have proved itself in service and to have demonstrated its suitability. It is also said to be more economical than other materials.

The methods of manufacture are described, with particular reference to the temperatures and pressures. Advantages claimed for this material and construction method are the obvious saving of aluminum and it is also said that the base is practically nonflammable, having good machinability and hardness properties of the hardest wood and steel. *Modern Plastics*, August, 1942, pages 57, 120, 3 illus.

Production

Aircraft-Industry Salvage Kinks. Harold A. Knight. The general trend in salvage methods being carried out by the aircraft industry is discussed, and what specific plants are doing in this direction is outlined. From a theoretic standpoint at least, it is believed that salvage operations in aircraft plants are more efficient and advanced than those prevailing in other industries. Reasons for this are that the raw materials used are the critical ones, such as aluminum, magnesium and nickel steels and also that the industry is new and therefore free from traditions tending to retard the installation of efficient systems. The trend is toward the use of more machinery for saving and segregating the scrap. Moving belts under machine tools to carry away turnings, and shorting machines incorporating magnetic separators are examples of magnetized salvage operations being used. Illustrations show salvage operations at a plant of the Wright Aeronautical Corporation. *Metals and Alloys*, August, 1942, pages 257–259, 2 illus.

Women in War Work. Michael H. Froelich. A consideration of the problems involved in the mobilization of women for aircraft manufacture, as judged by the experience of several major aircraft companies. The methods of solving these problems and acclimating women to the working requirements of the industry are discussed. The general conclusion is that although the employment of women has created some minor difficulties for management their aptitude and skill at specific jobs make the advantages far outweigh the disadvantages.

With reference to women's job performance, the following recommendations are made: that factory jobs for women be fitted to women; that as many operations as may be practical be arranged so that women may sit at their work, with all materials and tools close at hand; that jigs be set up wherever possible so that women can concentrate on employing more effectively their proved capacity for repetitive operations requiring high digital dexterity; that care be taken to evaluate the individual in terms of her basic character, coupled with an analysis of her mechanical aptitude. *Aero Digest*, September, 1942, pages 132, 135, 136, 258, 260, 262, 264, 298, 17 illus.

Production Breakdown Illustration. George Tharratt. This article describes a method for speeding the production of aircraft, as developed by the Douglas Aircraft Company. Because of the rapid expansion of the aircraft industry, it has been found impossible to teach all workmen to be mechanics, or even to read blueprints, in the time available. With the method described, each workman is given a sample picture of the part or assembly upon which he is working, together with a clear description of the operations and tools required to do the job. The method is stated to have proved of great value not only to the mechanic on the production line but also in other phases of the manufacturing process. In the design stage the illustrations facilitate closer coordination among the specialists responsible for solving many problems. The method also aids in the more efficient use of production line technique, the more accurate determination of material needs, and the speedier development of tooling and jigging requirements. Illustrations and a graph aid in the exposition of the method. *S.A.E. Journal*, September, 1942, pages 408–416, 8 illus.

Aircraft Armor Made Faster, Tougher. Detailed explanation of the Breeze method which is said to accelerate production of face-hardened plate for aircraft. This is done by carburizing the pretested plates with a liquid salts bath in an electric furnace under constantly controlled temperatures. A total of 50 separate labor operations is required by this process which is claimed to carry out three heats of carburized plate in 24 hours. *Aviation*, September, 1942, pages 120–122, 4 illus.

Increasing Production. Increasing the production of war supplies is taken up in an abstract of a memorandum published by the Council of the Institute of Production Engineers for presentation to the Minister of Production. Means suggested for accomplishing this are by increased machine activity, simplification of design, rationalization and improved manufacturing methods. The general situation with regard to machine activity is summarized as follows: (a) the majority of engineering machine

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1. Eat Right

Milk, butter, eggs, fish, meat, cheese, beans and peas, fruit, green leafy vegetables and the yellow ones, whole-grain or enriched cereals and bread—these are the *key* foods. Eat plenty of them. *And* eat 3 meals a day!

2. Get Your Rest

Regularity counts most. You can't catch up on *lost* sleep or *missed* relaxation! Try to keep on a regular schedule every day. Take it easy for a little while after lunch and dinner. Go to bed on time, get up on time.

3. See Your Doctor Once a Year

You have your *car* checked and serviced every thousand miles. Do as much for your body. Physicians can *prevent* many diseases and illnesses for both children and grownups nowadays. Give your doctor a chance *now*, BEFORE you get sick. Go to see *him!*

4. Keep Clean

Plenty of baths, lots of soap. Clean hands, clothes, houses, beds! Get fresh air, sunshine. Drink lots of water.

5. "Play" Some Each Day

Romp with the family, visit with friends, take walks, play games—or do whatever you like to give your mind and body a change from the daily grind on the job. "All work and no play makes Jack a dull boy."

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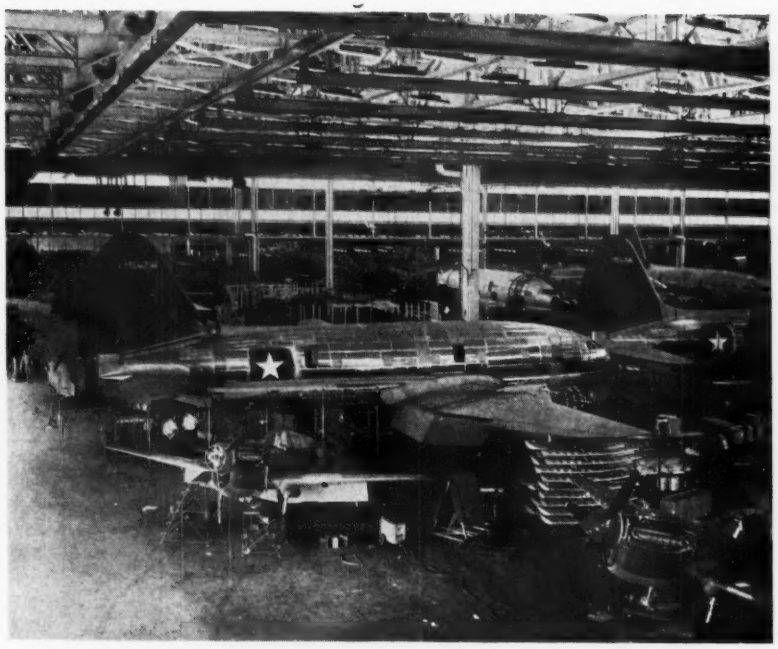
shops are still working a nominal two-shift system of, say, 55 hours a week; (b) many shops are working a day shift only; (c) there are new factories that have not yet even full day shifts; (d) three-shift systems or staggered shift systems are the exception. It is pointed out that if a higher percentage of full-time labor already at work were transferred to shift work, the vacancies on the day shift could, in many instances, be filled by part-time workers of whom many thousands are still available. It is suggested, therefore, that women of conscription ages should be classified by consideration of the domestic situation or health and be specifically assigned either to shift work or the day shift. In increasing machine activity gaps in the production must be considered, a subject that will require much study. Problems of rationalization, further standardization and placing of programs are discussed. *Aircraft Production*, August, 1942, pages 512, 513, 1 illus.

The Chobert Rivet Gun. A rivet gun said to be capable of speeding up the placing of rivets by unskilled help and to have other advantages is described. Its construction is explained, as well as the principles of operation. Specifications are set forth for the types of rivets and kinds of material for which the machine is adapted. *Aero Digest*, September, 1942, pages 186, 278, 5 illus.

Guns Cast Centrifugally. Brig. Gen. C. T. Harris, Jr. Antiaircraft and other guns with bore diameters ranging from 2 to 6 in. now can be cast centrifugally in the form of a single tube. Development of the monobloc gun has been carried out in an arsenal of the Ordnance Department of the United States Army. Until recently, all cannon were of the built-up type, it is explained, tubes, jackets and hoops being shrunk one on the other to obtain the necessary strength. With the new method, it is stated that savings in time, labor and material of from 25 to 40 per cent can be effected. The article also describes the arsenal in which this type of gun is manufactured. *American Machinist*, August 6, 1942, pages 822, 823, 3 illus.

The Why of Northrop's Engineering-Loft Technique. F. M. Gibian and Wes Chatten. The electroetching method of template duplication used by Northrop Aircraft, Inc., was subjected to further study to determine the most suitable procedure for the company's needs. In this article the writers explain why engineering vellum layouts in conjunction with the shop template method was chosen. *Aviation*, September, 1942, page 124.



The Curtiss Commando military transport (background) and the Curtiss Kittyhawk fighter under assembly at one of the plants of the Curtiss-Wright Corporation.

Fire Goes to Work. H. E. Linsley. The various kinds of heat-treatment used in the manufacture of aircraft engine parts are described in considerable detail. These include normalizing, annealing, carburizing, hardening and drawing, any or all of which may be applied, according to the type of material and the purpose it is to serve. Heat-treatment operations in a Wright Aeronautical plant are illustrated. *Air Trails*, September, 1942, pages 6, 44, 46, 4 illus.

Adaption of Castaloy Fixtures to Airplane Production Requirements. Harvey C. Groehn. Fixtures and methods intended to improve the tooling program for contoured sheet metal work are explained through a series of examples. Processes of making master models and templates are followed, including the construction of a mahogany model furnishing an accurate three-dimensional source of information from which a set of fixtures is made for casting by the use of special alloys. Presses, punches and other tools are described, as are the methods of forming an engine cowl and other aircraft parts.

Another process involves the use of plaster models cast from the mahogany master model. Several kinds of drill fixtures are detailed, as well as duplicating dies and checking fixtures. Other applications of these methods are for making subassembly fixtures and spot-welding fixtures. Advantages of the processes are summarized and data are tabulated on the shrinkage and expansion qualities of different types of fixture construction. *Aero Digest*, September, 1942, pages 197, 198, 201, 202, 207, 286, 12 illus.

Curtiss Propellers. Joseph Geschelin. The writer portrays production methods used in the manufacture of propellers by the group of plants comprising the propeller division of the Curtiss-Wright Corporation. For convenient distribution of power to machinery the overhead power duct system is used. Gravity roller conveyor systems are used for linking a family of operations. Metal cutting equipment is the most modern known to the art, it is stated. Cemented carbides are used for metal removal operations on steel. A special feature of the Curtiss propeller is the hollow steel blade. The various machining operations carried out in the manufacture of these propellers are described and numerous illustrations aid in an understanding of the processes. *Automotive and Aviation Industries*, August 15, 1942, pages 21–25, 17 illus.

Machining Oil Ring Forgings. Several novel machining operations and unusual tooling applications are used at the Republic Aircraft Products Division of Aviation Corporation in making oil rings for radial aircraft engines. After outlining the character of the work, the writer gives the operations, step by step, covering the machines employed, the fixtures and adjustments required and the dimensions maintained. *Aviation*, September, 1942, pages 125, 128, 131, 7 illus.

For Efficient Assembly: Save Motions and Simplify Operations. . . 1. J. M. Druliner and C. B. Kavanau. The first of a series of articles on methods that have speeded the assembly of aircraft parts at the Nashville plant of Vultee Aircraft, Inc. How the use of simplified operations and motion economy has brought about more efficient assembly is described. *Wings*, August, 1942, pages 87–91, 12 illus.

Jig and Fixture Details—III, IV. John G. Jergens. The third installment of this article continues the presentation of drawings of various types of standard details which can be used in the design of jigs and fixtures. Several of them involve the jig leaf, the leaf stop, the leaf clamp and methods for attaching a leaf which is to swivel. Others include a clamping method for round bars and for a movable slide. Several indexing mechanisms are also included. The fourth installment deals with several forms of jacks or work supports, thereby concluding the series. *American Machinist*, August 6, 1942, pages 824, 825, 14 illus.; August 20, 1942, pages 876, 877, 14 illus.

Production Equipment for Rolls-Royce Engines. Some recently released illustrations of production equipment used at the Packard plants for the production of the Rolls-Royce type of engine. These include gear generators, gear cutters and lathes. *Automotive and Aviation Industries*, September 1, 1942, pages 38, 39, 6 illus.

Supercharger Parts Take Top Production Methods. Short cuts and economies in the production of General Electric exhaust-driven superchargers are outlined. Expanding output due to war requirements has necessitated the application of unusual production techniques and the use of special equipment. Illustrations show methods of welding, machining and grinding parts. *Wings*, August, 1942, pages 106–109, 8 illus.

Thunder in the Making. Esther H. Forbes. All energies of the Republic Aviation Corporation at Farmingdale, N. Y., are being concentrated on the production of the P-47 Thunderbolt. The writer tells how these aircraft are being produced. The Thunderbolt is powered by the turbosupercharged Pratt & Whitney Double-Wasp engine and is stated to have a speed of more than 400 m.p.h.

A recent innovation at the Republic plant is the installation of powered assembly lines for engine, fuselage and final assemblies. To speed production, a telephone communication system between the men working inside the fuselage and those working outside is used. Women employees are now being used extensively, and they even operate the largest hydraulic press in the plant, a 350-ton press capable of exerting a pressure of 4,500 tons. *U.S. Air Services*, September, 1942, pages 41, 42, 2 illus.

The Work of the Ministry of Aircraft Production. Archibald Rowlands. Its Permanent Secretary explains the purpose of the Ministry of Aircraft Production and some of the methods by which it works. He affirms that the primary task of the Ministry is to create the conditions most conducive to maximum output. It decides, in consultation with the Naval and Air Staffs, what kinds of airplanes should be produced and how many of them should be made up to the full limit of the resources available. It lays down, controls, adjusts and oversees the fulfillment of the master plan of production but leaves the actual manufacture to private firms.

Another phase of the Ministry's problems noted by the article is the creation of an industry for the repair of damaged airplanes, engines, and equipment. In this connection special mention is made of the Emergency Services Organization, which rapidly

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repairs factories damaged by enemy bombing, and the organization responsible for the speedy dispersal of factories from highly vulnerable areas. *Flying and Popular Aviation*, September, 1942, pages 157, 158, 5 illus.

Smart Tooling Spurs the Mustang. Gary Stroh. An account of production methods used by North American Aviation in the manufacture of the P-51 Mustang fighter. The method of manufacture is built around three major subassemblies: the fuselage, the wing section and the engine. These in turn are broken down into many minor subassemblies, built up on jigs so that a large part of the work can be handled in small units. In process of manufacture, subassemblies are built up step by step until they flow into the final assembly line. Tools and materials are supplied to the operators at the proper points. The technique of jig design is an important feature of the system. Assembly jigs are built complete with compressed air and electric outlets, portable tools and rivet boxes. Only enough work is done in the jigs to make the subassembly sufficiently rigid for removal. The subassembly then goes to a supporting frame in which the remaining work or "pick-up" operations are performed. The first Mustang was completed just 100 days after design drawings were started, it is stated. *American Machinist*, August 20, 1942, pages 905–911, 8 illus.

Propellers

No Bottleneck in Propellers. Esther H. Forbes. The writer describes the production of Hamilton Standard propellers at the East Hartford, Conn. plant of United Aircraft Corporation. These propellers are made of aluminum alloy and must be hand polished for perfect balance and then painted. These operations are described in some detail. Both constant speed and hydromatic propellers are being produced at the East Hartford plant. They range in diameter from 7 to 17 ft. In addition to two- and three-blade propellers, four-blade propellers now are being provided for the 2,000-hp. Double Wasp engine. *Southern Flight*, August, 1942, pages 40, 41, 4 illus.

Research

NACA Engine Laboratory Is World's Largest. Description of the new $18,000,000 aircraft engine research laboratory built by the National Advisory Committee for Aeronautics for the purpose of increasing the effectiveness of aircraft engines. Already functioning is an engine-propeller research building. There will be, in addition, an engine research building, engine research wind tunnel, fuels and lubrication building, flight research hangar and an ice tunnel.

The completed engine-propeller building is devoted to investigating complete engines with attached and operating propellers. The main purpose of the engine research building is for investigations of single- and multicylinder engines to increase the horsepower output, engine economy, and the altitude of operation. Stratosphere conditions will be reproduced in the wind tunnel, and the fuels and lubricants laboratory will be used primarily for determining how the cylinder charge of present engines may be increased through the use of higher octane fuels to prevent "burning up" of the engine. Airplanes equipped with instruments and special testing equipment for flight investigations to check laboratory data will be provided in the flight research hangar, and the ice tunnel will be a refrigerated wind tunnel in which studies of ice formation on various parts of the airplane will be made, *Aviation*, September, 1942, pages 133, 314, 317, 3 illus.

Research and Development. Francis J. Linnell. The British Ministry of Aircraft Production's Controller of Research and Development details his responsibility with regard to aerodynamics, instruments, engines, fuel types, guns, bombs, material, propellers; for the investigation of the many ideas and inventions submitted; and all other aspects of aircraft improvement. The functions and work of each of his department's four Directorates are surveyed. *Flying and Popular Aviation*, September, 1942, pages 167–169, 273, 7 illus.

Rotating Wing Aircraft

Rotor Bending Moments in Plane of Flapping. Alexander Klemin, W. C. Walling and Wayne Wiesner. This paper, a problem in autogiro rotor stress analysis, can be outlined as follows:

1. Calculation of the characteristics of a typical autogiro employed for illustrative purposes.

2. Derivation of formulas for bending moments in the plane of flapping taking into account the effects of the weight of the blade, centrifugal force, inertia forces in flapping and aerodynamic thrust.

3. Examination of the effect of the azimuth angle Ψ on bending moments at a given point on the blade.

4. Effect of variations in μ, the tip speed ratio, on the bending moment at a given point on the blade.

5. Examination of the effect of the ratio r/R on bending moments.

6. Formulas for the centrifugal relief of bending moments.

7. Comparison of bending moments obtained by the above methods with the bending moments obtained by the use of empirical formulas available hitherto.

Certain simplifications have been employed. These are:

(a) Only the first harmonic of the flapping motion is considered.

(b) Terms of a higher order than μ^2 are neglected.

(c) The flow through the rotor disc is considered uniform.

(d) Mass distribution along the span of the blade is uniform.

(e) The product EI is uniform along the span of the blade.

(f) Stalling effects that may occur at portions of the blade are neglected.

(g) Periodic twisting of the blade is not taken into account.

The underlying aerodynamic theory is well known to those interested in the autogiro and no presentation of such theory is made in the paper. *Journal of the Aeronautical Sciences*, September, 1942, pages 411–418, 6 illus.

Stress Analysis

Tension and Compression Stress-Strain Characteristics of Cold-Rolled Austenitic Chromium-Nickel and Chromium-Manganese-Nickel Stainless Steels. Russell Franks and W. O. Binder. The demand in recent years for lightweight high-strength structures, especially in the transportation industry, has created considerable interest in the corrosion-resisting chromium-nickel and chromium-manganese-nickel steels. These steels are austenitic in character, and their strength can be most economically increased by application of cold-work, which, together with composition, determines their ultimate mechanical properties. Data have been published on the cold-rolled chromium-nickel steels, but practically no information is available on the austenitic type of chromium-manganese nickel steels. The present paper gives data on these latter steels. The effects of various degrees of cold-work on steels of different compositions are presented in order to describe those steels that have high strength associated with good ductility, which is important from the standpoint of fabrication of the sections required for lightweight high-strength construction.

The paper gives information on the stress-strain properties of the steels in both the longitudinal and transverse directions to rolling and shows

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the improvement obtained in these properties by application of the low temperature (200° to 300°C.) stress-relieving heat-treatment. It further shows that the 17 per cent chromium-7 per cent nickel steels, and the 17 per cent chromium-5.50 per cent manganese-4.50 per cent nickel steels have better tension and compression properties longitudinal to the direction of rolling than do the 18 per cent chromium-8 per cent nickel steels, particularly when the steels are cold-rolled to a tensile strength exceeding about 150,000 lbs. per sq. in. All these steels have better compressive properties transverse to the direction of rolling than longitudinal to the direction of rolling, but this difference is less marked in the 17 per cent chromium-7 per cent nickel steels and the 17 per cent chromium-5.50 per cent manganese-4.50 per cent nickel steels than in the 18 per cent chromium-8 per cent nickel steels. An attempt has been made to present the data on the steels so they will be of greatest value to the designer of lightweight high-strength structures. *Journal of the Aeronautical Sciences*, September, 1942, pages 419–438, 71 illus.

The Stresses Developed in Sections Subjected to Bending Moment. J. L. Beilschmidt. It is stated that in the case of certain aircraft materials that have an extremely low limit of proportionality as compared with the ultimate strength of the material the limit of proportionality as a definable point does not exist. Therefore, it is apparent that since formulas based on the law of proportionality cease to apply as soon as any fiber in the section is working at a stress above the proportionality limit it is useless to quote the maximum fiber stress as a criterion of rupture of the fiber of maximum strength against the ultimate stress of the material. However, it is standard practice in the stress analysis of aircraft structural components to quote reserve factors on the ultimate or yield stress of the material in respect of a maximum fiber stress value, which may be well above the limit of proportionality. It is shown that although apparently inconsistent and incorrect the practice applied under certain conditions will not give rise to any appreciable inconsistency and that a definite purpose can be fulfilled.

Emphasis is placed on the fact that this method of stress determination is useful only as these conditions can be maintained. Discrepancies are likely to appear in the strength and deflection values determined by the calculations described, against results obtained by mechanical tests. Discrepancies of this kind which are noticeable in the case of certain light alloy components were primarily responsible for indicating the need for an extension of the bending theory to include the full effect of the nonlinear stress-strain characteristics for practical application to the design of cast and forged airscrew blades, control levers and other aircraft components.

The writer proceeds to a general consideration of the effect of the stress-strain characteristic of the material on the moment of resistance of a section.

A discussion follows on the use of allowable ultimate stress adjusted to cover proof stress requirements on the basis of nonlinear stress-strain characteristic. Consideration is also given to the degree of accuracy attainable. Effect of the stress-strain characteristic of the material on the position of the neutral axis is studied and the neutral axis position for nonsymmetric sections and dissimilar tension and compression characteristics of the material are defined. *The Journal of the Royal Aeronautical Society*, July, 1942, pages 161–180, 13 illus.

Designing Web-Flange Rivet Connections for Shear Stresses. Part I—Shear Resistant Webs. Harold C. Martin. This article has a twofold purpose: (1) to discuss the nature of shear stresses—especially horizontal shear stresses which affect the web-flange rivets of built-up beams or spars—and show how they may be calculated simply; and (2) to construct design charts for the quick selection of rivet patterns. The subject resolves itself into two parts, the first dealing with beams having shear-resistant webs and the second with an investigation of beams in which the webs buckle under the shear load.

Part I develops a mathematical calculation of the magnitude of the horizontal shear stress and the force acting on the web-flange rivets. To avoid the tedious solution of several equations, a simplified method is suggested and tables are presented to facilitate the work of the layout draftsman. Illustrative problems clarify the text. The article is to be continued. *Aero Digest*, September, 1942, pages 162, 165, 166, 279, 280, 6 illus.

Superchargers

Energy Transfer Between a Fluid and a Rotor for Pump and Turbine Machinery. Sanford A. Moss, Chester W. Smith, and William R. Foote. An extensive analytic treatment of the energy transfer between a working fluid and a rotor for pump and turbine machinery. The analysis provides a means for obtaining the particular sort of vane angles and general arrangement best for a machine for a particular service and for determining the detailed dimensions of a machine for particular pressure conditions. A single general formula is derived which applies to every sort of machine and which is reduced to a particular form for every particular machine. A kinematic treatment of rotor energy is first given. It was disclosed in the discussion following presentation of the paper that the term "rotor energy" refers to the flow of energy between rotor and fluid rather than the kinetic energy of the revolving rotor. A hydraulic and thermodynamic treatment of fluid energy follows. Relations set forth are then applied to pumps and turbines of the axial-flow and of the radial inward- and outward-flow types.

In the aircraft field the subject has particular application to engine superchargers. In the discussion following presentation of the paper K. A. Browne of the Wright Aeronautical Corporation states that aircraft-engine supercharging is being accomplished solely by the radial-vane impeller. Vaned diffusers are used primarily to reduce the diameter of the compressor, a factor becoming more critical with every step forward in engine performance. In the last ten years, aircraft engines have quadrupled in power output for the same diameter or head area; compressor design has kept in step by not requiring more than its same proportion of space. Now the emphasis is on altitude performance, up to 40,000 ft., where the volume to be handled is four times that at sea level and the total pressure ratio is around 8. Based on conventional practice, the size and weight of the necessary compressors increase prohibitively. In spite of the basic advantages of the centrifugal type, serious consideration is being given the axial-flow compressor. *Transactions of the A.S.M.E.*, August, 1942, pages 567–597, 24 illus.

Testing Equipment

Vibration Fatigue Tests for Seam-Sealing Compounds. Ronald L. McFarlan. Eleven primary factors must be taken into consideration in developing a seam-sealing compound for use in high-altitude, pressurized-cabin aircraft, and other factors enter into the problem for specific units. The purpose of this article is to describe test apparatus and procedures to determine the vibration fatigue resistance of various seam-sealing compounds for a temperature range from −90° to +160°F. Three general types of apparatus for this purpose are classified as: (1) a small test unit for preliminary evaluation only; (2) a

PHOTOS COURTESY ANDERSON AIRPLANE SCHOOL

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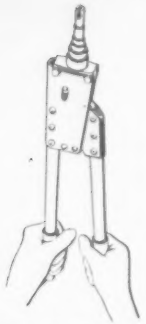

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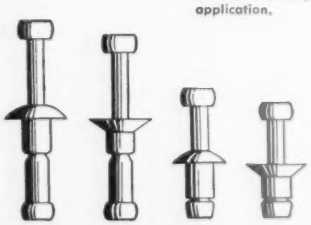

From left to right, the self-plugging type with brazier and countersunk heads—the hollow type with both styles of heads.

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unit in which direct contact with an oscillating rod flexes the test panel; and (3) a unit in which the flexure of the test panel results from its own inertia when the panel is fastened to a vibrating box. Each of these units is particularized and methods of conducting the tests are shown. *Aero Digest*, September, 1942, pages 211, 212, 289, 6 illus.

Tools and Equipment

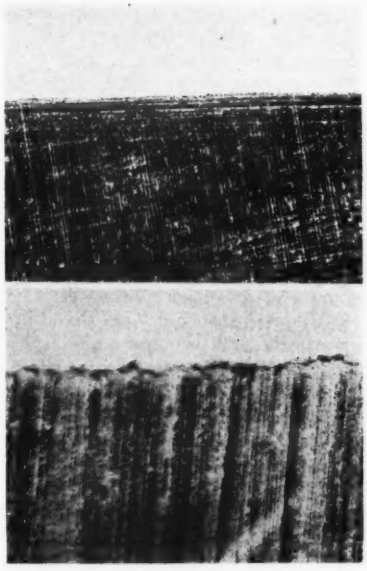
Punches Cut Their Own Dies. John Haydock. The writer describes a new type of piercing die now being used by a number of aircraft manufacturers. The novel feature of these dies is that once the male half or punch is formed it cuts its own female die. Advantages pointed out include simple construction, low initial cost, short setup time, high quantity production, small storage requirements and low repair cost. Steps in making these simplified dies for dural or Alclad parts are described and illustrated. *American Machinist*, August 6, 1942, pages 815–818, 10 illus.

Training

Double or Something. Lt. Ken Lester. An Air Force Training School student discusses the difference in procedure and technique of single-engine and twin-engine flying. Various maneuvers in piloting a twin-engined airplane are explained. The writer's conclusion is that the most important thing stressed in the twin-engine training curriculum is to fly level. *Air Facts*, September, 1942, pages 10–20, 4 illus.

The Gunner's the Man! Capt. Ammon McClellan. The writer describes the duties of aerial gunners and tells how they are trained. In a bombing airplane the gunners handle the heavy machine guns in the tail turret, in the upper turret on top of the fuselage, and in the lower turret in the belly. Side guns are fired by the radio operator and engineer in the event of an attack by fighters. The training of gunners at the Army Air Force gunnery school at Tyndell Field, Fla., is explained. The course of five weeks includes both classroom preparation and practical application of the firing of guns. *U.S. Air Services*, September, 1942, pages 13, 14, 1 illus.

Operators Solve Problems of Expanding Air Forces. William D. Strohmeier. The problems, procedures and methods of handling the flight department at Hawthorne School of Aeronautics are outlined. Particulars are given on the four main activities under the direct supervision of the flight director. These



Wright Aeronautical Corporation photomicrographs show (*bottom*) the sawtooth edge of a hand-ground cutting tool and (*top*) the straight edge of a precision-ground cutting tool produced under the new method that increases the life of tungsten, cobalt and molybdenum tool steel as much as 2,000 per cent.

are: (1) acquisition and training of flight instructors; (2) regulation and control of flight activities; (3) flight dispatching; (4) flight accounting. Since it is claimed that no student or instructor has ever been injured in course of training, the safety record of the school is offered as testimony to the effectiveness of the system. *Aviation*, September, 1942, pages 235, 236, 293, 294, 297, 3 illus.

Bomber Pilot. How advanced training is compressed into nine weeks of intensive study and practice for student bomber pilots at the Bombardier-Pilot Replacement Center at Ellington, Tex., is narrated. Instruction includes identification of aircraft and naval vessels, aerial navigation, armament, antiaircraft fire, bombing theory, interpreting photographs and reviewing instrument flying. Almost as much time, however, is given to actual flying, mostly in multiengined training planes, learning formation flying and working out realistic combat and bombing problems. *Dixie Air News*, August, 1942, pages 5, 6, 1 illus.

Wings for American Youth. Roscoe Drummond and Glen Perry. Details are given on the plan of the Air Training Corps of America to give preflight training to 2,000 boys in the high schools and secondary schools of the United States. It is pointed out that these school courses will be helpful in saving the Air Forces months of investigation and training and will speed up the placing of the graduates in the military services after they complete their school work. The curriculum includes the study of the Morse code, model building, aircraft identification and the rudiments of the technical subjects leading to the training of pilots. Credit is given to numerous leaders who have sponsored this movement, and it is believed that it will have much to do with preparing America for the air age to come after the war. *The Saturday Evening Post*, August 22, 1942, pages 19, 65, 66, 3 illus.

Training and Manpower. A discussion of the Royal Air Force's training organization by the Air Member for Training on the Air Council. In addition to following the step-by-step progression in a pilot's training, the article outlines the preparation given to other members of the aircrew and touches upon that accorded ground crews. It is explained why elementary and advanced flying students are trained in Canada and the United States. The advantages claimed for this system are that it gives the Royal Air Force not only enormous local resources, but sources of skilled auxiliary man power, airdromes in open country, freedom from enemy interference, absence of restricted areas and black-out conditions, and climate that is ideal for the early stages of flight training. The duties and responsibilities of the different departments are outlined. *Flying and Popular Aviation*, September, 1942, pages 107–110, 206, 215, 216, 15 illus.

Pilot's Pool. The step-by-step process aviation cadets go through in training at the Gulf Coast Air Force Training Center is described and illustrated by means of a flow chart. Mass production of bombardiers, navigators and pilots is going on at the rate of more than four per hour at this training center, it is stated. *Western Flying*, August, 1942, pages 43, 82, 1 illus.

Civilian Schools Build Army of Instructors for Air Forces. A new program for training 6,000 more civilian instructors for the nation's air forces is being instituted by the Civil Aeronautics Authority in cooperation with the Army and Navy. How several civilian-owned-and-operated schools are being employed in this program is related in a brief article that tells of the rigid standards that must be maintained. *Air News*, September, 1942, pages 33, 34, 7 illus.

The Story of CPTP—Part 3. Robert H. Hinckley. This is the last of three articles dealing with the Civil Pilot Training Program by the former Assistant Secretary of War, who is credited with having fostered the development of the program. He re-

views the contributions of C.P.T.P. during the "national defense" period and after the United States entered the war. Figures are given on the numbers of pilots, trained by C.P.T.-P., who have joined the flying services. It is stated that at the end of June, 1942, the program had trained about 72,000 civilian pilots. Of these, more than 20,000 were in the air forces of the Army, Navy and Marines and an additional 10,000 were serving in other branches of the armed services.

The writer also makes several comments about the development of the C.P.T.P. after the war. He declares that the project must be broadened to include noncollege youth, that it must again be opened to women, and that the air-conditioning program, which is designed to extend aviation education down into the grade schools, must be fully exploited. *The Sportsman Pilot*, August, 15, 1942, pages 8–11, 32, 35, 5 illus.

Army Glider Pilot Training Program. Recounting the rapid expansion of the United States Army Glider Forces and describing the advantages offered by the glider training course for men from 18 to 35 years old. A selected number of glider pilots will be commissioned as second lieutenants after completing a six-week course. Others completing the course will become staff sergeants. *U.S. Air Services*, September, 1942, pages 15, 46, 1 illus.

High School Air Force. The opportunities for high-school students interested in aviation offered by preflight training courses starting this fall are set forth. Training will be an accredited part of the high- and secondary schools' curriculums. The courses offer an excellent means for the student to find out something about his abilities and inclinations. *Air Trails*, September, 1942, pages 22, 50, 2 illus.

Aerial Gunners! The Army Gunnery School at Harlingen, Tex., and its course of instruction are described. Studies include the mechanism of the guns, aircraft identification, judging speeds and distances, rifle practice and actual shooting with machine guns. Power turrets mounted on a truck are used on the ground range to simulate the relative speeds of fast-moving airplanes, after which the student is given final training in shooting from a plane on the air range. *Dixie Air News*, August, 1942, pages 7, 8, 32, 1 illus.

Hangar Flying. Howard Hasbrook. A pilot taking the C.A.A. instructor refresher course tells how he learned to conform to the precise and exacting flying standards of the Army. He mentions several flying operations in which he was taught to abandon his former rough or careless piloting methods. Visual reference and proper air speed are stressed as the two most important factors necessary for military flying. *The Sportsman Pilot*, August 15, 1942, pages 24, 25, 48, 1 illus.

Pre-Flight Plan Hardens Navy's Pilot Material. Lt. (J.G.) Fred Tupper, Jr. Preflight schools established and maintained by the United States Navy at four leading colleges are described. The program by which the the men are hardened physically and taught to overcome the enemy in hand-to-hand combat is based on rigorous athletic activities from which all thought of sportsmanship is eliminated. Intensive study of mathematics, physics and naval strategy is another important feature in attaining a balanced training routine to develop coordination of mind and body. *Air News*, September, 1942, pages 26, 27, 13 illus.

Technical Training for Ground Forces of AAF. Doris S. Hunt. The intensive course of training which the ground forces of the A.A.F. are put through at the Miami, Fla. training center is portrayed. The Officer Can-

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didate School, the Officer's Training School and the Replacement Training Center are concentrated at Miami. By making use of five hotels at Miami instead of building new quarters, from three to six months of valuable time was saved. The school is made up of enlisted men and draftees who have been selected as officer material by reason of outstanding qualifications. The men are given twelve weeks of intensive training and are turned out as second lieutenants, ready for combat duty. *U.S. Air Services*, September, 1942, pages 17, 18, 44, 2 illus.

Training Naval Aviation Technicians. Lt. (J.G.) Fred Tupper, Jr. The curriculum for training enlisted navy men to become aviation technicians is detailed. Subjects covered in the basic shop course are shop mathematics, ordnance, signaling, mechanical drawing, and hand tools. After this preliminary training, the men are ready for actual airplane instruction. This is subdivided into three sections: airplanes, which includes dope and fabric shop, cables, wheels and brakes, hydraulics and propellers and structures; engines, with work in electrical equipment, carburetors, engine accessories, oil systems, and complete engines; and line operation, with actual servicing, flight inspection, 30-hour inspection and repair, and assembly replacement. Those of the men assigned to become metalsmiths go to the sheet metal shop for instruction in soft soldering work such as heating, dressing and tinning of soldering coppers, use of noncorrosive flux, soldering of sheet metal, copper, brass, galvanized iron and cold rolled iron, lap seaming and tacking and silver soldering.

The advanced course takes place in the welding shop. The men then receive three months of intensive training in the art of welding and cutting with hard soldering, oxyacetylene apparatus and welding of aluminum and special metals. Finishing and heat-treating complete the course. *Aero Digest*, September, 1942, pages 88, 92, 385, 4 illus.

Glider University. One of the Army Air Forces temporary advanced glider schools is located at Amarillo, Tex. This article describes the way fledgling pilots are trained to handle gliders. The difference between gliders and airplanes is briefly outlined. Instruments located on the glider's dashboard include air speed, turn and bank, and rate-of-climb indicators and an altimeter. During the two weeks' training course students fly all kinds of motorless aircraft, including giant troop carriers. *Southern Flight*, August, 1942, pages 36, 37, 39, 1 illus.

Satan's Angels. How fighter pilots are trained at the Gulf Coast Air Force Training Center is related. Combat flying, formations, breaking away from flights, gunnery practice through "dry runs" over ground and air targets and, finally, actual firing with a tracer-marked stream of bullets give the students the desired training. *Dixie Air News*, August, 1942, pages 29, 30, 1 illus.

Supplying Factory Personnel by Training Within Industry. C. R. Dooley. A discussion of how the airplane industry is building up its labor reservoir by training its own recruits. Four principal points advocated are: (1) the upgrading of all classes of personnel as their experience and abilities warrant, through planned job progression, job rotation, and intensive supplementary instruction both on and off the job; (2) development of production specialists through intensive instruction on the job according to basic operations; (3) development of all-around skilled mechanics through trades apprenticeship, in accordance with Federal standards, separate from production-worker training, for the purpose of developing a predetermined, limited number of all-around journeymen mechanics; (4) development of supervisors through careful selection, assignment of supervisory duties of increasing responsibility, and provision for related organized help through discussions and conferences under both plant and outside auspices, dealing with training in the method of instruction, planning, and working relationships.

As an example of actual accomplishment in this field by the airplane manufacturers, the article relates the experience of the Wright Aeronautical Corporation in building up a force of 10,000 workers for their Cincinnati plant from a group of about 300. This program, it is reported, was built upon the following eight steps: (1) the slicing-up of skilled jobs into segments for which one man could be quickly trained; (2) analyses of all the steps of the jobs for production and instruction purposes; (3) forecasting of employees by stages to match plant construction and machine installation; (4) cooperation with local agencies in planning pre-employment training for certain operations; (5) scheduling training on the job; (6) consistent following of the policy of upgrading; (7) apprenticeship training; (8) supervisory development. *Aero Digest*, September, 1942, pages 116, 118, 227, 228, 5 illus.

From Plebe to Pilot the Navy Way. Photographs and a description of the routine steps taken by the embryo pilot in his progressive training course at the new $3,000,000 Naval Reserve Aviation base at Los Alamitos, Calif. From the Squadron 1 primary stage acquired there and at 14 other schools, the student moves through classes designated as Squadrons 2 for transition; 3 for instruments; 4 for flying boats; 5 for observation, scout flying, dive and torpedo bombing and catapult and carrier practice; and to 6 for fighter practice. *Western Flying*, August, 1942, pages 54, 55, 17 illus.

Warfare

Bomb Salvo No. One. William Flynn. Description of an experiment conducted in 1911 when Lt. Myron C. Crissy dropped an explosive bomb from an airplane. This is termed the first serious, scientific effort to adapt the airplane as a weapon of war. Weighing but 6 lbs., the bomb blasted a crater 3 ft. in diameter and 2 ft. deep. The experiment proved that an airplane could carry an explosive missile without danger of premature explosion. It also showed that some degree of accuracy could be obtained through scientific design of the bomb casting. *Air Facts*, September, 1942, pages 21–25.

The Air Battle for Voronezh. Lt. Col. S. Shevyakov. A graphic description of the part played by the Soviet air force in the battle for Voronezh and the heroic deeds of Soviet pilots in action. In June the Germans began to concentrate on a series of airdrome agglomerations withdrawing air units from various fronts and from the interior. Information from some captured German pilots made it clear that the German command was concentrating a huge force for a blow at Kursk and Voronezh. Because of the action of Soviet air units, the enemy's plans were, to a large degree, frustrated. *U.S. Air Services*, September, 1942, pages 16, 31.

Air Ministry. Arthur Street. With a diagram of the setup for clarification, the organization and duties of the Royal Air Force governing body are outlined. At its apex is the Air Minister who has sole responsibility for the business of the Air Ministry and who, with the help of two junior ministers, must defend its actions in Parliament. In addition to these three, the Air Council includes the executive heads of the chief depart-

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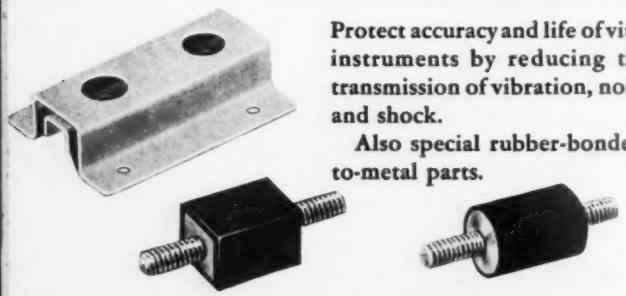

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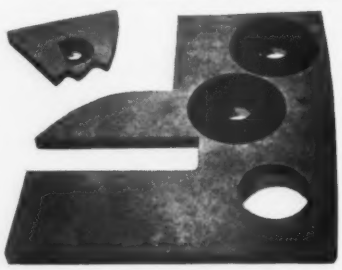

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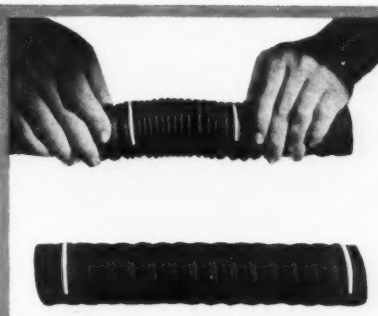

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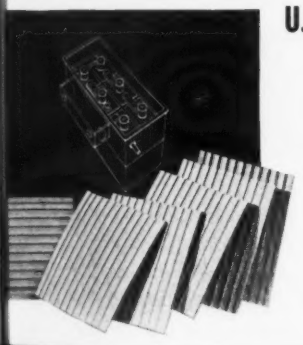

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ments into which the Air Ministry is divided. These are: the chief of the air staff (planning, operations, tactics, intelligence); the air member for personnel (personnel, management, welfare, and health of R.A.F. and W.A.A.F. personnel at home and overseas); the air member for supply and organization (supply and servicing of equipment, logistics, transportation civil engineering); the air member for training (combat and flight training of aircrews and technical training of ground staff); the permanent under-secretary of state (policy, exchequer, purchases, accounts, public relations, and administration). The four other members of the Air Council who are not heads of any Air Ministry departments are the vice-chief of the air staff, a member who advises the Air Council on financial and kindred questions, and two members who belong to the Ministry of Aircraft Production. *Flying and Popular Aviation*, September, 1942, pages 43–45, 12 illus.

The Master Weapon. Major Gen. J. F. C. Fuller. In modern warfare it is the airplane that sets the pace, the writer points out. So far as range is concerned, the master weapon is the airplane. It has the power to carry war into the third dimension. The history of early weapons is traced. The functions of the army, navy and air force in modern warfare are discussed. *Army Ordnance*, September–October, 1942, pages 268–271.

Bomber Command. Arthur T. Harris. A report on the organization, functions, personnel, equipment, and operations of Britain's Bomber Command is given by its Commander-in-Chief. The development of the Bomber Command from a small force in the early days of the war into the huge armada now striking at Germany's vital centers is traced, with an account of its operations at each point of the war.

A step-by-step description is given of a typical bombing expedition from the time the aircrews receive their instructions until reconnaissance planes take photographs of the damage that has been done. The article also includes a discussion of bombing attack strategy and particular note is taken of the heavy raids that have been made recently on Germany—Rostock, Lubeck, Cologne, etc. *Flying and Popular Aviation*, September, 1942, pages 46–50, 55–60, 23 illus.

Polish Squadrons in the R.A.F. Henry Baerlein. This article gives an account of Polish Squadrons in the Royal Air Force. It cites the toll of the enemy that has been taken by them, tells how their units were formed, and describes some of their exploits.

Comparing a considerable number of fighter, bomber and cooperation squadrons, the Polish operational air force is both part of the R.A.F. and part of the Polish armed forces. While the general direction of training, matters of administration and supply are in British hands, an Inspectorate of the Polish Air Force has the decisive voice in matters of general organization and personnel. The entire personnel of the squadrons, crews, and ground staff, is Polish. Polish flying schools assure the exchange of operational pilots and the replenishment of losses. Observers and air gunners assembled in Polish units get their basic training in British schools, while all crews receive their battle training in Polish battle-training units. *Flight*, August 6, 1942, pages 149–153, 7 illus.

Fighter Command. Sholto Douglas. Britain's Fighter Command is described in detail by its Air Officer Commanding-in-Chief. Besides an analysis of its varied duties—offensive, defensive and convoy—a record is given of its operations throughout the war. This includes actual figures on the number of fighter planes engaged in combat, losses to both sides, number of flights made per day, etc. The reporting and plotting system that brings fighter aircraft defense into action is depicted and the different tactics employed in day and night fighting are explained. *Flying and Popular Aviation*, September, 1942, pages 61–69, 20 illus.

Russia as a Base for A.A.F. John Ward. Maintaining that at present the most vulnerable part of Germany's war machine is her air force, this article advocates a concentration of a great bulk of the United States Army Air Forces in Russia to supplement Soviet air strength. Routes are suggested for the delivery of such reenforcements. In addition to offering a point of vantage for blows against Germany, the value of such a move in the event of a Japanese attack upon Siberia is given. In order to take such a step quickly and efficiently, the article also recommends the immediate formation of a separate Air Force command. *Aero Digest*, September, 1942, pages 83, 289, 290–294, 1 illus.

Coastal Command. Philip B. Joubert. The Air Officer Commanding-in-Chief, Coastal Command, interprets the tasks confronting the division of the Royal Air Force under his direction and tells how these are being accomplished. To the west, the Command is faced with the task of protecting the sea routes; on the east, there is the equally important tasks of reconaissance against invasion, and striking the enemy's invasion ports and supply shipping; while, supplementing these is the constant task of preventing the German surface raiders from breaking out into the Atlantic.

Besides an outline of the development of the Coastal Command since 1918, the article portrays the importance of the role it has played from the early stages of the war in the still raging "Battle of the Atlantic." Since 1941, this Command, while remaining a part of the Royal Air Force, has come under the operational control of the Admiralty. Its strength, scope and policy are the result of agreement between the Air Ministry and the Admiralty. One of its chief functions is that of attacking enemy shipping.

The article also describes the airplanes used by the Coastal Command and gives brief account of the strategy it employs in attacking the enemy. *Flying and Popular Aviation*, September, 1942, pages 70–75, 15 illus.; "Preserving the Life Lines," *The Aeroplane*, July 31, 1942, pages 136, 137, 3 illus.

The Fighter's Triumph. A commentary on how German air forces were resisted and turned back in the Battle of Britain, mainly through the efforts of British fighter pilots and their aircraft. The article's conclusion is that although the Germans had the benefit of greater numbers Britain possessed the advantage of quality. It contends that British airplanes were better than the enemy's in fire power, maneuverability and armor and that Britain's well-trained, practiced pilots were able to make the most of these advantages. *The Aeroplane*, August 7, 1942, page 157, 1 illus.

Army Co-Operation. Arthur S. Barratt. Data on the activities and composition of the British Army Co-operation Command which furnishes aerial support for ground soldiers are given by the man who heads it. Since tactical and strategic reconnaissance is one of the primary functions of the Command, part of the article is devoted to an interpretation of the importance of the information furnished land forces by this aerial contingent. Other of its tasks described are spotting for artillery, close support, and attack of battlefield targets.

The writer explains how his division of the Royal Air Force cooperates with the army in the field, traces its development from the opening days of the war, names the types of planes that are used, and tells of the combination of pilot and military intelligence training that is required for its personnel. *Flying and Popular Avia-*

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tion, September, 1942, pages 76, 77, 254, 256, 5 illus.

Will Nazi Air Raiders Use Gas? Capt. Burr Leyson. A potential war weapon of the Luftwaffe is analyzed in a study of the gases used in chemical warfare. These are separated into five classes, commonly known as the tear gases, the lung irritants, the systematic toxic agents, the vesicants or mustard gases and the sternutators or sneezing gases. Each class is described in nontechnical language, with information on the chemical composition, physical effects and points of identification. It is stated that no new gas is likely to be developed and that all gases used in the first World War had been known to chemists for years. Only certain combinations and their application to warfare were new. Estimates are quoted from sources in the United States Army Chemical Warfare Service on the methods and equipment needed to carry out a gas attack on a city such as New York. A chart presents the characteristics, uses, effects, antidotes and other data concerning 16 of the major war gases. *Air News*, September, 1942, pages 10–14, 12 illus.

East of Suez. This article tells how high mobility of air power is relied upon for the defense of the long coastline of India. After a brief biography of Sir Richard Peirse, the Air Officer Commanding-in-Chief in India, the action in that part of the world is traced. Tribute is paid to the native airmen and some information is given on the plans for meeting further aggression by the enemy. *Flying and Popular Aviation*, September, 1942, pages 78, 270, 4 illus.

The Real Bombing of Germany. The elements needed for an all-out air offensive against Germany are summarized. Authorities disagree on whether or not a concentration of Anglo-American air power on the scale assumed in the summary can be achieved this year. But, if it can be done, it should be done now, the writer emphasizes. Through no other means can American mass production strike so quickly so hard a blow at the heart of the enemy, it is stated. Calculations on what can be done with the types of aircraft now being used by the Allies are furnished. *Time*, September 7, 1942, pages 71–74, 4 illus.

The Middle East. Arthur William Tedder. A report of British aerial operations is given in this history of Britain's campaigns in the Middle East since the entrance of Italy into the war. The authority of the report is derived from the fact that it was written by the Air Officer Commanding-in-Chief, Middle East. Among the campaigns commented upon are those in Greece, Crete, Syria and Iran. The writer stresses the point that the War in the Middle East has been a series of battles for airdromes. Facts are given about the outcome of each campaign as well as figures on losses, number of planes used, etc.

The area in which the Command now operates is outlined as follows: The eastern area embraces the western Desert and Libya. To the south, control is exercised over the whole of Egypt and the Sudan, Abyssinia, British Somaliland, and Kenya—to the center of Africa. On the east and northeast the control ranges through Iraq and Iran to the borders of India, while to the north there is Palestine and Syria, Malta and Cyprus. To the northeast the Command adjoins Soviet territory and in Syria it cooperates with Turkey. *Flying and Popular Aviation*, September, 1942, pages 79–85, 262, 264, 266, 18 illus.

An African Crossroads. Data are given on the activities of a German-Italian long-distance reconnaissance squadron in Africa which undertook an armed reconnaissance against Fort Lamy. Standing at the junction of the Lagone and Schari rivers near Lake Chad, the fort, which is controlled by the Free French, is an important strategic point in the United Nations' supply line to Egypt. The writer expresses the belief that the raiding German plane may have taken off from a Vichy airdrome in Africa. *The Aeroplane*, August 7, 1942, page 165, 1 illus.

Malta, G.C. A picture of life on the Island which has withstood more than 3,000 air raids includes an explanation of why it is imperative for the enemy to bombard it. Seventy miles south of Sicily and 200 east of Tunis, Malta is of great strategic importance in a Mediterranean war. From its airdromes United Nations aircraft can operate against Italian production and supply systems, as well as Axis shipping routes to the Middle East. In addition to quoting figures on the number of raids on Malta and the damages caused by them, the article depicts them in progression. *Flying and Popular Aviation*, September, 1942, pages 86, 230, 234, 2 illus.

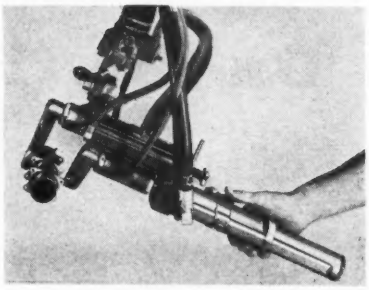
Hitler's Offense Makes Major Front of Vast Middle East. Leonard Engel. A broad view is presented of the military tactics and strategy required of the United Nations in the Middle East and Far East. Lines of communication now available are surveyed, especially the vital link between Suez and Burma, where the three major routes consist of the Trans-Iranian railroad from the Persian Gulf to the Caspian Sea and

Russia, the air route from Cairo to Baghdad and Russia, and the air route from Sadiya in Northeast India to Chungking in China. What steps the Allies would have to take in the event of loss of either of these lines are discussed, it being noted that the oil resources of the Middle East and the Caucasus are among the important prizes at stake. Three possible courses of action are suggested for the Allies: a mile-by-mile reconquest of the Middle East and Indian Ocean territories, a second front in western Europe, and more aid to China and Russia, in all of which air power would take a leading part. *Air News*, September, 1942, pages 18–20, 11 illus.

Ceylon. J. H. D'Albiac. The Air Officer Commanding, Ceylon, discusses the strategic importance of Ceylon and tells what is being done to build up the Royal Air Force defense there. In addition to the obvious intention of the Japanese to capture Ceylon as part of their avowed line of conquest, he points out that they must try to occupy it in order to strengthen their own vulnerable northern fronts. After describing the Japanese attacks on Ceylon which have already taken place, he poses the claim that Ceylon is now a self-contained stronghold. *Flying and Popular Aviation*, September, 1942, pages 95, 96, 275, 2 illus.

Welding

Tentative Standards and Recommended Practices and Procedures for Spot Welding of Aluminum Alloys. This article contains information recently published in pamphlet form by the American Welding Society. The report is the result of nine months of work by a technical committee and represents tentative recommendations for standards of weld quality and performance as well as general recommendations of the best practices and procedures to be followed in spot welding of aluminum alloys in the aircraft industry. It also contains a general discussion of the theory of spot welding, particularly as applied to aluminum in the aircraft industry. The subjects covered include standards of weld quality, surface preparation for spot welding, welding technique, methods of testing, methods of inspection, design of spot-welded parts, welding equipment and installation, as well as a short dissertation on personnel requirements and production methods. The committee was composed primarily of welding engineers of various aircraft companies who attempted to provide a practical guide for those engaged in the spot welding of aluminum alloys. Graphs, curves and illustrations accompany the text. *The Welding Journal*, August, 1942, pages 517–555, 32 illus.



The new "Progressive" low-pressure welding gun for spot welding light gauge alloy steels.

Arc Welding Applications. E. W. P. Smith. A basis is suggested for the discussion of welding problems of aircraft manufacturers. Different points of view may be taken such as: (1) the manufacture of a part and the effect of its shape upon operating results; (2) welding and its effect upon the material and the performance of the part; (3) a combination of these factors. Chrome molybdenum steels are considered with reference to their applicability to welding. Methods and electrodes and procedures are reviewed and types of joints are explained. Comments are made on certain specifications for strength of joints. It is indicated that although present welding routines are producing excellent results, there is no reason why further improvements cannot be found. *Aero Digest*, September, 1942, pages 180, 182, 228, 288, 6 illus.

Wind Tunnels

The Wind Tunnel Grows Up. Roy E. Marquardt. The first of a series of semitechnical articles on aerodynamics and the employment of wind tunnels in aircraft development. This article deals with the use of models as a means for the final determination of air forces acting on the full-scale airplane. Early experiments are outlined and the development of wind tunnels is described. Diagrams show the apparatus used by Eiffel to measure the drag of falling objects, the wind tunnel built by Stanton in 1903, the wind tunnel of the Guggenheim Aeronautics Laboratory at the California Institute of Technology, and the variable-pressure wind tunnel at Langley field. There is also a photograph of the new North American wind tunnel, which makes possible testing at wind speeds up to 327 m.p.h. A sketch shows the layout of the Lockheed aerodynamics laboratory completed last year. *Western Flying*, August, 1942, pages 36–38, 80, 82, 10 illus.

Miscellaneous

The Airplane Remakes World Geography. George T. Renner. Presenting the thesis that the whole strategy of men, space and resources which we call geography exists only as it is conceived in men's minds, this article advances the argument that the airplane has changed geography and that to win the war national psychology must be altered to conform with the change. After tracing the development in map making from a plane basis, through cylindrical and equal-area ocean basin maps, the writer shows the need for a new map based on world areas as judged by airplane travel. Although he claims the value of recognizing this new geography is lost as an advantage in preparing for the war, he recommends the utilization of it in postwar plans. *Aero Digest*, September, 1942, pages 107, 109, 110, 382–384, 4 illus.

Morale in Air Raids. V. L. Gruberg. A series of articles on the psychologic value of air attacks upon civilian populations. Reducing it to a formula, the writer shows the variation in intensity of the important psychologic factors. He states that, contrary to the belief of those who advocate intense and frequent attacks, past experience would seem to indicate that hatred of the enemy grows proportionally with such attacks while fear decreases.

Listed as the main psychologic and material factors to be considered are: intensity of raids, frequency of raids, fear, hatred of the enemy, material attachment, air-raid protection facilities and antiaircraft defense, and intensity and kind of influence of the domestic propaganda.

The conclusion is drawn that, in consideration of German national characteristics, intense and incessant air attacks upon Germany stand a good chance of breaking the people's aggressive war spirit. *Flight*, June 25, 1942, page 640, 1 illus.; July 2, 1942, pages 18, 19.

Carbon Monoxide Detection. The dangers of carbon monoxide in airplane operation are explained, its potential sources indicated, and devices for detecting its presence suggested. With illustrated examples, characteristic and functional details are given on several different types of indicators, catalytic as well as "alarm." *Canadian Aviation*, July, 1942, pages 23, 58, 59, 3 illus.

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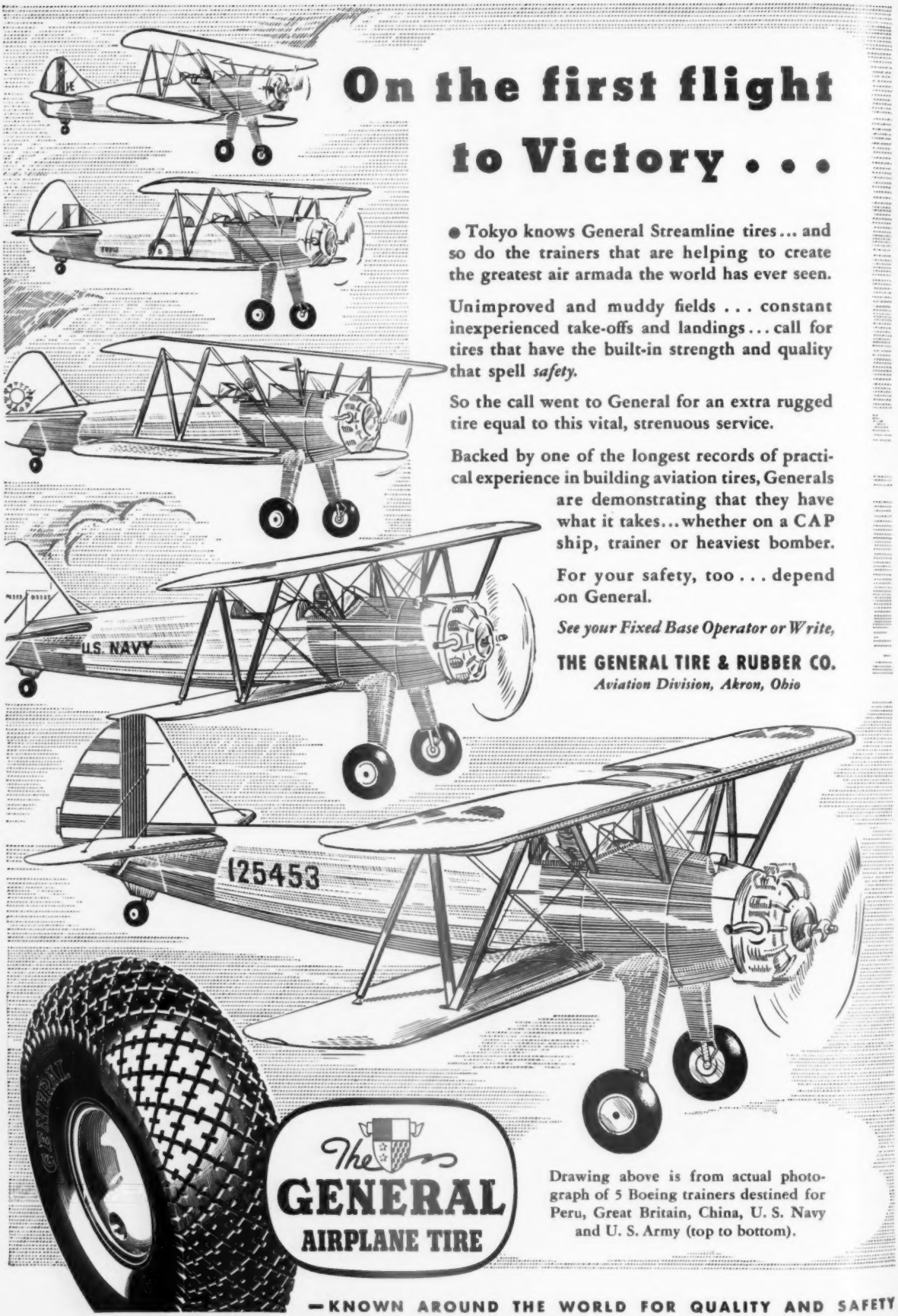

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Drawing above is from actual photograph of 5 Boeing trainers destined for Peru, Great Britain, China, U. S. Navy and U. S. Army (top to bottom).

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Government Publications

Army Air Forces

Air War in the Aleutians. Exploits of American airmen in the Aleutian Islands theater of the war are described. Fog as well as the Japanese must be dealt with in this area, and the writer draws a picture of the difficult conditions with which airmen have to contend. In addition to fog, these include long days, short nights that are never really dark and great flying distances which use up fuel. *Air Forces News Letter*, July, 1942.

Airdromes in Wartime. Lt. Col. Rudolph E. Smyser. This is a continuation of a discussion on the construction of military airdromes. Peacetime methods of airdrome construction with runways laid out in rigid geometric patterns and intentionally made conspicuous are held to be undesirable for operational fields. Recommendations are made for runways and for dispersal parking or revertment areas. In general, taxiways should follow the perimeter of the landing area. The writer continues with further constructional details, including service and storage facilities. *Air Forces News Letter*, July, 1942.

Gliders for War. Capt. Herbert O. Johansen. An article discussing the importance of the glider as a military weapon, its adoption by the Army Air Forces, and the many possibilities it offers in the solution of war transportation problems. It is stated that by towing a single glider the load transported by a cargo airplane can be doubled with the loss of only about 12 per cent in efficiency. Experiments with a nonstop glider pickup system at over 100 m.p.h. are described and illustrated. *Air Forces News Letter*, July, 1942.

The Great Zero Mystery. Lt. John M. Jenks. In this article Japan's method of designating its military aircraft is explained. The last two numerals of the year the plane was put in service are used. Compared to our calendar, Japan's begins at 660 B.C., so that the year 1940 becomes 2600. Consequently, 1940 models are designated as 00, often referred to as "Zero." A letter T preceding the numerals simply stands for "type." The designation gives no indication of what type the airplane is. The Zero fighter usually referred to is a single-seater navy airplane made by Mitsubisi and is often called the Mitsubisi Zero. Features of the Zero are outlined and some other Japanese aircraft are illustrated. *Air Forces News Letter*, July, 1942.

'Ole Miss' Goes to Java. Capt. Al Key. This article is another story of that handful of American airmen who waged the Battle of Java. In 1935 the writer and his brother flew the Stinson monoplane "Ole Miss" for 653 hours and 34 min. over their home town. The experiences and exploits of these brothers in Java are described. *Air Forces News Letter*, July, 1942.

National Advisory Committee for Aeronautics

Self-Ignition and Combustion of Gases. A. S. Sokolik. Translated from *Progress of Physical Science* (U.S.S.R.), Vol. 23, No. 3, 1940, pages 209–250, this paper is devoted essentially to those investigations of recent years in which new combustion phenomena or new methods of studying them experimentally are brought out or to investigations that throw new light on already known phenomena. The subject is developed through consideration of self-ignition of gaseous mixtures, fundamental laws of self-ignition, investigations of short induction periods, flame propagation, retarded luminosity of the flame and temperature gradient, flame vibration, and detonation. The paper is illustrated by 36 figures. *N.A.C.A. T.M. No. 1025*, August, 1942.

Thermal Theory of Combustion and Explosion. N. N. Semenov. Translated from *Progress of Physical Science* (U.S.S.R.), Vol. 23, No. 3, 1940, pages 251–292. After brief remarks on the chemical kinetic theory, the writer passes on to the particular subject of this paper which is the present state of the thermal theory of combustion and explosion. It is noted that three conditions should be satisfied for every chemical transformation capable of leading to ignition, that is: (1) The transformation is accompanied by heat liberation; (2) it occurs at a more or less slower rate at temperatures lower than the ignition temperature; and (3) it is accelerated with increase in the temperature. A definition is developed for the ignition temperature and remarks are made on the nature of self-ignition. The writer traces the formulation of the correct thermal theory of dielectric breakdown and then proceeds to a mathematical presentation of the heat theory of combustion and explosion, divided into three parts: (1) the thermal theory of self-ignition, (2) the theory of ignition by hot bodies, and (3) the theory of flame propagation. Illustrations consist of 13 graphs. *N.A.C.A. T.M. No. 1024*, August, 1942.

Civil Aeronautics Administration

Weight Control of Air Carrier Type Aircraft. As a result of comments received from air carrier operators, aircraft manufacturers and other interested agencies, and in order to take cognizance of progress in aircraft design and within the aircraft industry itself certain revisions have been made by the Aircraft Engineering Division to the material in Safety Regulation Release No. 80. These changes will not materially affect existing systems of weight control but rather are intended to expand present practice to cover future developments in design. It should be understood that deviations from any of the practices recommended will be accepted if it can be demonstrated to the satisfaction of the Administrator that all airworthiness considerations are met.

The document continues with detailed directions covering the manufacturer's responsibility and the operator's responsibility for weighing, loading instructions and weight-control procedures. It supersedes Safety Regulation Release No. 80. *C.A.B. Safety Regulation Release No. 121*, August, 1942.

Nation's Aviation Assets Growing Through CPT Program. How the Nation's aviation assets are growing as an indirect result of the C.A.A.'s pilot training program is given. While direct results are

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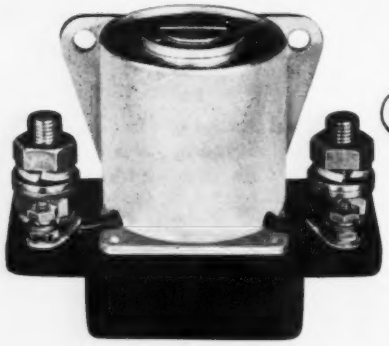

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found in the achievements of young airmen all over the world, indirect results are appearing at hundreds of colleges and universities in the form of college-owned airports, new aeronautical engineering schools and buildings, college airplane wind tunnels, hangars, and a growing list of air-minded faculty members. Details of these results, obtained by a check of reports from institutions throughout the country, are published. *Civil Aeronautics Journal*, August 15, 1942.

Civil Aeronautics Board

Protecting Aircraft from Weather Elements. W. E. Koneczny. This Bulletin deals with the protection of aircraft from weather effects. Sun, rain and humidity are elements against which measures are suggested. Canvas, lubricants and antirust compounds are advised for the protection of various aircraft parts. Special attention is paid to fabric-covered airplanes, wood propellers, and means for guarding against wind damage to grounded aircraft. *C.A.B. Safety Bulletin No. 140.*

So You Want to Fly—Safely. A leaflet issued as a safety guide for student flyers. Ground, sky and weather rules are presented here. The need for alertness and courtesy in the air is emphasized.

Department of Commerce

Dive Bombers from Skimmed Milk. Products of every conceivable character, including aircraft parts, can be fabricated from casein products, the article states and casein is destined to play an ever increasing role in United States war efforts. The ease of extracting protein, which exists in colloidal form in milk, is emphasized. If necessary, it could be made with improved wooden equipment in small creameries. Aside from the United States, Argentina is the largest producer of casein. The method of manufacture in Argentine plants is described. *Foreign Commerce Weekly*, August 15, 1942.

Office of War Information

Not Cargo Planes vs. Combat Planes, But Planes vs. Other Products, Locke Declares. An excerpt from a speech by E. A. Locke, Jr., assistant to the chairman, War Production Board. The decision on how many cargo planes to make is a choice between airplanes and other equipment, rather than between cargo and combat types of aircraft, it is stated. The real problem is whether steel and tools are being used to best advantage at present or whether their desirability

should be altered by directing more of them into the production of airplanes and less into the production of guns, trucks, tanks and ships. *Victory*, August 11, 1942.

War Department

Airplane Inspection Guide. The purpose of this manual is to furnish airplane mechanics, inspectors and other maintenance personnel with the necessary information for the inspection of airplanes, airplane engines and auxiliary equipment. The instructions cover information necessary to fulfill the requirements of the various periodic inspections included in the visual inspection system for airplanes. Sections cover preflight inspection and the inspection of structures, propellers, instruments, hydraulic systems, and fuel and oil systems. *Technical Manual 1-415*, March 7, 1942.

British Information Services

"Fighter Sweeps" Aid Second Front. Peter Marsfield. Large-scale air raids on France by the R.A.F. Fighter Command have been going on for more than 18 months. These fighter sweeps are forcing Germany to maintain a defensive force of 30 first-line squadrons that otherwise could be used in Russia and Africa, it is stated. Germany desperately needs fighter planes, yet 500 of the enemy's best fighters must be kept in France to meet the raids. Other aims of fighter sweeps are also described. *Bulletins from Britain*, July 29, 1942.

Victory Flies on Big Bombers' Wings. Sir Charles Bruce-Gardner. The decision to use heavy aircraft, such as the Stirling, Halifax and Lancaster bombers, which the R.A.F. has used in numerous mass raids on the enemy this year, originated at a conference held by the British War Ministry as long ago as May, 1936. Factors entering into the decision were the desire to carry larger bombs and the simplification of airdrome "traffic" problems. It is stated that it is much easier to send off and receive home 20 bombers each capable of carrying 50 tons of bombs than to cope with 50 bombers each carrying bomb loads of only 2 tons. Recent air raids on enemy territory with these heavy bombers have proved that they are worth the additional man-hours required to manufacture them. *Bulletins from Britain*, August 5, 1942.

Bombers Smash Factories and U-Boat "Nests." J. H. Johnstone. Comparisons are drawn between the R.A.F. Bomber Command's recent offensive against German war industries and the heaviest raids made by the Luftwaffe in the past. In no attack did the German raiding force exceed 550 machines, and only a small minority of the bombs used exceeded 500 lbs. in weight. Three R.A.F. raids with forces of more than 1,000 airplanes each have been carried out, it is pointed out, using few bombs of less than 1,000 lbs. and some weighing 4,000 lbs. While the German attacks were spread over many hours, R.A.F. raids were compressed into one or one and a quarter hours. The writer discusses how these mass air raids with heavy bombers are helping to win the war. *Bulletins from Britain*, July 22, 1942.

India and Burma Squadrons of the R.A.F. This entire article is devoted to a review of the accomplishments of the India and Burma Squadrons of the R.A.F. Chapters cover the four "Madras" squadrons, the "City of Bombay" Spitfire squadron, the three "East India" Spitfire squadrons, the "United Provinces" Hurricane squadron, the two "Punjab" fighter squadrons, the three "Hyderabad" squadrons, the "Mysore" fighter squadron, the "Baroda" Spitfire squadron, and the "Burma" Hurricane squadron. The achievements of the various units are described in considerable detail and the equipment is illustrated. *"Wings of the Empire."*

Australia—Maker of Warplanes. Describing with illustrations the progress Australia is making in aircraft manufacture, as revealed in an interview given to Reuters in August, 1941, by Australia's Commissioner of Aircraft Production. *War in Pictures*, E. W. P. 22.

The Giant of the Bomber Command—The Mighty Short "Stirling." An illustrated description of Britain's Short Stirling bomber, which with a wing span of over 99 ft. and a bomb-carrying capacity of 8 tons can attain a speed of 300 m.p.h. This bomber underwent four years of development before it was used by the R.A.F. in 1940. A sectional drawing shows the general design of the plane. Photographs show the instrument controls, bomb-aimer's position in the nose, and the chief engineer's panel. *War in Pictures*, E. W. P. 22.

Air-Sea Rescue. A booklet describing the activities of the British Air-Sea Rescue Service, which is controlled by the Director-General of Aircraft Safety in the Air Ministry. It explains how airmen who have been forced down at sea are rescued. The part the Royal Navy plays in this work also is outlined.

Any aircraft available are used for air search. Some are fitted to drop dinghies and other rescue equipment. Royal Air Force surface craft consist of pinnaces, two types of high-speed launches and seaplane tenders, the latter suitable for calm weather only.

Fundamentals of Air Fighting. The information contained in this booklet was derived from official reports of actual air combats and operations. It is intended to impart something of what has been learned of air operations thus far and to encourage initiative and study of the subjects covered. The principles of gunnery, air fighting, formation and evasion are discussed, and the importance of physical fitness is emphasized.

Rolls-Royce Proves That British Girls Can Make Aero Engines. Illustrations are presented of girls assembling Rolls-Royce Merlin engines. Some recent improvements in the engines these girls are helping to build are described. At one Rolls-Royce factory one-third of the employees are girls. *War in Pictures*, May, 1942.

Star Performers of the Royal Air Force. Illustrations and a brief description of aircraft used by the Royal Air Force which are the most outstanding in their respective classes. Both American and British airplanes are shown. These include the Hurricane II, called the most heavily armored single-engine high-speed fighter; the Catalina, said to have the longest flying range of any flying boat; the Short Stirling, which, apart from the new Lancaster, is said to be the largest bomber in the world on active service; the American Grumman Martlet, fastest fighter used by the Fleet Air Arm from aircraft carriers; the American Havoc, used as a night fighter; the American Lockheed Hudson, mainstay of the Coastal Command; the Bristol Blenheim 4, general purpose machine; the Spitfire, fastest airplane in the R.A.F. except for the Hawker Typhoon, which is not yet in service; and the Bristol Beaufort, fastest torpedo carrier of the R.A.F. *War in Pictures*, May, 1942.

2,000 R.A.F. Major Bombing Raids, During 774 Nights. John L. Young. Germany's boast about smashing Britain from the air and the brilliance of the British defense has occupied attention to such an extent that people are apt to forget the other battle which has been raging for two years with increasing intensity—the battle of Germany. Between June 17, 1940, and August, 1942, the British Royal Air Force carried out more than 2,000 night raids alone on major targets in Germany and German occupied territory. In addition there have been many daylight raids and night raids on nearer targets. Further details and figures on these raids are given. *Bulletins from Britain*, September 3, 1942.

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Aeronautical Education

The Air Age Education Series of 18 books, sponsored by the Institute of the Aeronautical Sciences, represents a major step in providing schools with teaching materials. Simplified texts, well illustrated, are supplemented by instruction to teachers for presentation. The Aviation Research Group of Teachers College, Columbia University, prepared much of the program for student education in aeronautics. Supported by, and having the cooperation of, the Civil Aeronautics Authority, this series of textbooks will provide elementary and high schools with books covering the entire range of aeronautical studies. The price of each book has been kept low so that students can buy them without undue expense. The question and answer plan at the end of each chapter is followed throughout the series and adequate bibliographies and glossaries are included.

Prof. Ben D. Wood of Columbia University, who is Chairman of the Education Committee of the Institute of the Aeronautical Sciences, writes in the Foreword that the series "will aid American education to eliminate the hiatus between technical aeronautical advances and popular understanding of aviation as a revolutionary world force today and tomorrow."

Human Geography in the Air Age, by George T. Renner; 238 pages, $0.64.

Social Studies for the Air Age, by Hall Bartlett; 169 pages, $0.60.

Teachers' Manual for Elements of Pre-Flight Aeronautics for High Schools, by Aviation Education Research Group, Teachers College, University of Nebraska; 113 pages, $0.48.

Flying High, by Rose N. Cohen; 320 pages, $0.76.

Elementary School Science for the Air Age, by Charles K. Arey; 145 pages, $0.72.

Wings for You, by E. A. Cross; 355 pages, $0.76.

The Air We Live In, by George T. Renner; 47 pages, $0.36.

Geographic Education for the Air Age, by George T. Renner; 17 pages, $0.20.

Aeronautics in the Industrial Arts Program, by Gordon O. Wilber and Emerson E. Neuthardt; 252 pages, $0.92.

Globes, Maps, and Skyways, by Hubert A. Bauer; 75 pages, $0.40.

Books reviewed in this section may be borrowed without charge from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, 30 Rockefeller Plaza, New York, N. Y.

Science of Pre-Flight Aeronautics for High Schools, by the Aviation Education Research Group, Teachers College, Columbia University; 868 pages, $1.32.

Elements of Pre-Flight Aeronautics for High Schools, by the Aviation Education Research Group, Teachers College, University of Nebraska; 556 pages, $0.96.

Teachers' Manual for Science of Pre-Flight Aeronautics for High Schools, edited by George Franklin Stover; 248 pages, $0.80.

Education for the Air Age, by N. L. Engelhardt, Jr.; 55 pages, $0.24.

The Biology of Flight, by Frederick L. Fitzpatrick and Karl A. Stiles; 162 pages, $0.64.

Physical Science for the Air Age, by J. G. Manzer, M. M. Peake, and J. M. Leps; 198 pages, $0.80.

Teachers' Manual for the Biology of Flight, by Frederick L. Fitzpatrick and Karl A. Stiles; 27 pages, $0.20.

Mathematics in Aviation, by George Osteyee; 186 pages, $0.64.

All of the foregoing books are published by the Macmillan Company, New York, 1942.

Aviation Medicine

As an example of careful research, painstaking compilation and clarity of printing this bibliography could well serve as a model for others. The Institute of the Aeronautical Sciences published a preliminary bibliography in the same field several years ago and hoped that experts on the whole subject would eventually prepare a more critical and complete work. This has been done by Dr. Hoff and Dr. Fulton with the cooperation of many persons and libraries. It was prepared under the sponsorship of the National Research Council. Just at this time when aviation medicine is becoming of such great importance in our war effort the utility of this bibliography will be of the greatest value to engineers as well as flight surgeons. It is an outstanding contribution to aeromedical research.

A Bibliography of Aviation Medicine, by Ebbe Curtis Hoff and John Farquhar Fulton; Charles C. Thomas, Springfield, Ill., 1942; 237 pages, $4.00.

Defense Against Air Attacks

The author evaluates the experiences gained during air attacks in Spain, France and England. Every aspect of defense organization is considered purely from a technical point of view, such as medical organization, etc., and is explained in broad detail.

The book attempts to bring home not only to the individual but also to official organizations the responsibility of lessening the danger of loss of lives in defense against air attacks.

Defensa Pasiva Contra Aeronaves (Passive Anti-Aircraft Defense), by D. Miguel Morayta Ruiz; Editorial Tecnica Unida, Brooklyn, N.Y., 1942; 158 pages, $2.75.

Battle Narrative

The achievements, as well as the lack of air power, in the battles of Singapore and Burma are described in this reporter's narrative with a close view that could hardly be more vivid. The author, who was one of the two reporters on the "Repulse," gives an eyewitness account of the sinking of that warship and of the "Prince of Wales." Fortunately, he was able to save his carefully taken notes so that the details of the attack are recorded with great accuracy.

The book praises the gallantry of Colonel Chenault's pilots, the small detachment of the R.A.F. and the British and colonial troops. Scathing criticism of the rich traders and official English is made all through the book. As a panorama of the military, naval and air action in the East, probably no one will write a book with such intimate details. The story of defeats and withdrawals make humiliating reading, but it contains lessons that must be learned before it will be possible to retrieve the enormous losses sustained

in a few weeks. The author is a South African who writes with commendable impartiality.

Action in the East, by O. D. Gallagher; Doubleday, Doran and Company, Inc., Garden City, N.Y., 1942; 300 pages, $2.50.

Navigation Lesson Course

This course, No. 2-A, consists of 15 lessons in celestial navigation. Definitions and symbols are given in the introductory pages and in the first two lessons. The instruction combines the text and problem methods, setting forth the facts bearing on the particular subject and then requiring the solution of specific problems. In connection with the work involved in this course, reference is necessary to textbooks, notes and charts published by the author and others, each lesson carrying an assignment to be worked out through the use of such collateral texts. The lessons are as follows: (1) preliminary definitions, celestial navigation equipment; (2) time and hour angle, conversion of arc into time and vice versa; (3) the American Air Almanac; (4) the timepiece, radio time signals; (5) the theory of celestial navigation; (6) celestial navigation equipment, the sextant, corrections to sextant altitudes; (7) converting observations to positions, solutions of the astronomic triangle by line of position book; (8) meridian altitudes, latitude by Polaris, earth's rotational effect on the bubble sextant (coriolis acceleration); (9) lines of position using DR position, precomputed altitudes, computing the azimuth by LPB, graphic methods of finding great circle courses and distances; (10) sidereal time, star altitude curves; (11) review; (12) sunrise and sunset; (13) solution of problems using H.O. 214, review SN lesson six; (14) azimuth diagrams by use of H.O. 214, solution of problems using H.O. 214; (15) the day's work.

At the end of the lessons, an examination is presented which consists of practical questions in aircraft navigation.

Navigation Course, by Percival V. H. Weems; Weems System of of Navigation, Annapolis, Md., 1942; 159 pages, $7.50.

Methods of Welding Metals

A new book on welding is offered in which the purpose of the author is to provide a general description of modern methods of welding metals with special emphasis on the welding of iron and steel. In opening, the author treats of welding with gas heat. Welding torches, as well as gas-pressure gauges and regulators, are described. A study is made of the oxyacetylene flame. Other chapters deal with the characteristics of electric arc welding, the sources of current for arc welding, electrodes and holders, welded joints, the metallurgy of welding, tests of materials and welds, the weldability of metals, and safety equipment. Included in an appendix is a table on trouble-shooting for arc welding and information on welding machine parts made by powder metallurgy.

Welding, by James A. Moyer; McGraw-Hill Book Company, Inc., New York, 1942; 185 pages, $2.25.

Air Corps Training

Another of a series of books telling in interesting text and numerous illustrations what a cadet and officer should know. This book describes the life of a cadet in the Army Air Forces and in Army Aviation from the time he enlists until he becomes an officer pilot, a bombardier, navigator, radio operator, gunner or parachutist. Like others in the series, it tells a full story in human-interest pictures. One of the authors, F. P. Graham, is an experienced aviation editor and the other, H. W. Kulick, is an expert photographer. The team has produced a book that any young man anticipating a call for army duty and wishing active duty can read with interest.

He's in the Air Corps Now, by Frederick P. Graham and Harold W. Kulick; Robert M. McBride & Co., New York, 1942; 218 pages, $2.50.

Diesel Study Course

This Diesel study course in revised form covers Diesel engines for electric generation, mechanical power and transportation, and includes a chapter on aircraft engines. The chief revisions are in the statistics and mathematics presented. Being intended for an instruction book, each chapter is followed by an examination lesson. The student is expected to write his answers to these questions and then turn to the back of the book where a complete list of answers is furnished.

After giving a general picture of the Diesel engine industry, basic principles of engine design are taken up and the student is told why parts are built in certain ways and how the Diesel engine operates. Slow-speed, medium-speed and high-speed types of Diesel engine are covered. The design of the frame, cylinders, reciprocating parts and valves is given special attention. Fuel, air, lubricating, cooling and starting systems are discussed in detail.

As an aid to the student, one chapter deals with engineering fundamentals. Among the aircraft engines described are the Junkers, Bristol, a horizontal opposed-cylinder Beardmore, Guiberson radial Diesel, Deschamps and Mercedes-Benz.

Diesel Engines, by L. H. Morrison; Diesel Publications, Inc., New York, 1942; 824 pages, $8.00.

Revised Welding Book

The second edition of the *Welding Handbook* has been published to provide in concise form the latest information on welding. In this book the physics and metallurgy of welding and the weldability of steels are the subjects first covered. The next part of the volume deals with welding and allied processes. The materials used, training, inspection and safety, design considerations and testing of welding, and, finally, the application of welding are discussed. While arranged in handbook style for the particular use of engineers, the presentation of the subject is such that the book may be used as a textbook in engineering schools and as a reference book in trade schools.

Welding Handbook; American Welding Society, New York, 1942; 1,593 pages, $6.00.

Engine Maintenance Text

While this book is devoted mainly to a study of how to keep aircraft engines in such condition that maximum efficiency and length of service may be obtained from them, it does not adhere strictly to the subject on hand. A large portion of it deals with an explanation of the construction and operating principles of the engine. This treatment is prompted by the theory that with a basic knowledge of the mechanism itself the reader is in a better position to cope with the problems involved in the maintenance of the engine.

Consideration is given to the theory of operation, the factors of operation, engine components, fuels, fuel systems, and refueling. Lubrication, ignition, instruments, accessories, propellers, and installation are discussed in detail. There are also chapters on vibration, operation, inspection, service, and repair.

Aircraft Engine Maintenance, by James H. Suddeth; John Wiley & Sons, Inc., New York, 1942; 374 pages, $2.75.

Arc-Welding Procedure

In this seventh edition of the Procedure Handbook information on arc-welding design and practice has been

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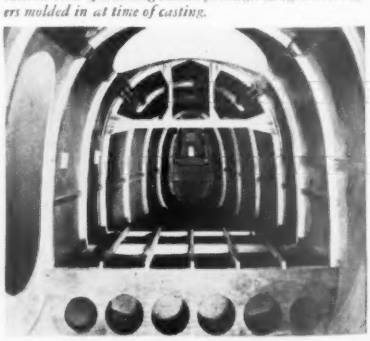

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Procedure Handbook of Arc Welding Design and Practice; The Lincoln Electric Company, Cleveland, O., 1942; 1,267 pages, $1.50.

Naval Narrative

This small book differs from most of those written about the British Royal Navy. It tells of the struggle of the officers and men to perform their duties all over the world and to defend their home land against enemy action on, over and under the sea with ships and equipment held to be inadequate for the tremendous burdens suddenly thrust upon them. Tribute is paid to the skill, courage and devotion of these men, said to be far too few in number. Criticism is directed at the policies of naval economy prevailing for some twenty years prior to the war which are charged with responsibility for the lack of equipment and man power. Attention is also called to the difference between the present situation and conditions during the first World War, when the British Navy had the cooperation of French, Italian, Russian and eventually American fleets. In this war the British Navy had to fight practically alone until the recent entrance of the United States. The balance of power between that event and the not inconsiderable reinforcement of the enemy's naval strength by the addition of the Japanese forces is assessed.

The narrative covers the exploits of the Royal Navy and its Fleet Air Arm to the end of 1941. In the closing chapter it is pointed out that the English-speaking peoples will be required to maintain strong naval and air forces, that continued cooperation is apparently the best assurance of peace, and that control of the air as well as of the sea is imperative for future security. There are 41 illustrations, largely devoted to naval operations.

Britannia Has Wings, Sir Archibald Hurd; Hutchinson & Co. Ltd., London, 1942; 112 pages, 5*s*.

Air Power Prophet

Friends and admirers of Brig. Gen. William Mitchell will regret the emphasis the book places on the period of his life when frustration, disappointment and the mental reaction were so much in evidence. As long as he devoted his ability to predicting the future of aircraft in peace and war, he was a prophet who will ever hold a high place in the history of aviation. When he became involved in attacks on aeronautical interests and was made a part of a fishing expedition of a Congressional Committee, many of his friends were disappointed that he should permit his talents to be used for such a purpose.

The thread of the controversy is carried all through the chapters of the book which, instead of being an impartial account of his career, gives a picture that does not add to the earlier reputation of a man who will always be regarded as the great proponent of air power.

Billy Mitchell, by Emile Gauvreau and Lester Cohen; E. P. Dutton & Co., Inc., New York, 1942; 303 pages, $2.50.

Study of Fluids

It is stated that the traditional course in hydraulics is largely based upon empirical formulas valid only for water. Recently, the trend has been toward modification to include consideration of liquids in general and, to a more limited extent, gases. This book is offered as a modern introductory course in the subject of fluids. The basic method of analysis throughout the text is that of the free body, used in conjunction with the fundamental principles of mechanics, expressed in Newton's law of motion. In many of the developments conventional amplifying assumptions have been introduced to keep the treatment within the mathematical ability of the undergraduate.

Mechanics of Fluids, by Glenn Murphy; International Textbook Company, Scranton, Pa., 1942; 329 pages, $3.25.

Plywood Manufacture

Quantitative technical information on plywood is furnished in this book, which is a reprint of a series of articles that appeared in *Hardwood Record*. The subject matter is divided into five parts which cover the strength, deformation and elastic stability of plywood sheets; the elastic theory of wood and plywood; the manufacture of plywood; the warpage of plywood; and the bending, molding and embossing of plywood. The formulas given in the first part should be helpful to engineers in the design of structures in which plywood sheets are used as stressed-skin coverings.

Technique of Plywood, by Charles B. Norris; I. F. Laucks, Inc., Seattle, Wash., 1942; 249 pages, $2.50.

Principles of Airplane Flight

A booklet intended to give some of the principles on which airplane flight depends. It is suitable for those who wish to obtain a general knowledge of airplane flight and also as a prelude to the study of more advanced books on the subject. The first chapter discusses the atmosphere. This is followed by chapters on airplanes and their wings and controls. The concluding chapters deal with airscrews, engines, and types of airplanes. Diagrams aid in clarification of the subject.

How Aeroplanes Fly, by W. O. Manning; Oxford University Press, London, 1942; 64 pages, 2*s*.

School Welding Text

In this text an attempt is made to lay a thorough foundation for students in all fundamental welding processes so that an understanding may be had of the new methods and new welding devices that are constantly being developed. The book has been prepared especially for public schools, with particular emphasis on the proper techniques in welding in order that beginners may become acquainted with correct welding practices,

Theory and practice of the two major methods of welding are treated, the oxyacetylene method and the electric arc method, with information on the equipment and supplies for these operations. Direct-current arc welding and alternating-current arc welding are explained, as well as the practice, equipment and supplies used in electric resistance welding. Special forms of welding receive attention, including work with ferrous and nonferrous metals, pipes and tubes, soft and hard soldering and the cutting of metals. Chapters are devoted to the manufacture of metals, studying their properties and identification and heat-treatment, and extensive information is given on the equipment and operation of a welding shop. Review questions at the end of each chapter serve to fix the subject matter in the mind of the

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student. The book concludes with a chapter of technical data, including definitions of terms, symbols and tables, and specifications covering acceptable work. Illustrations have been supplied by numerous manufacturers, showing equipment and methods.

Modern Welding Practice, by Andrew D. Althouse and Carl H. Turnquist; The Goodheart-Willcox Company, Inc., Chicago, 1942; 412 pages, $4.00.

Principles of Parachutes

Uses of parachutes in war and in peacetime pursuits, details of their making and the scientific principles upon which they work are the subjects of this book. The first chapters trace the history and development of the parachute from its probable origin in China, the results of early experiments more than 200 years ago, and its first practical use in saving life. The laws of gravity and of wind resistance and the other fundamental principles involved are explained, as well as the practical problems to be solved in descending from great heights.

Chapters are devoted to the training of parachutists and paratroops and the employment of parachutes by all branches of the armed services of the United States. How parachutes have been developed for peacetime service in a wide range of occupations is given a prominent place in this study of the safety device that has contributed so much to the progress of aeronautics. It is shown that the nonmilitary value of the parachute is constantly increasing, some of the uses including the dropping of fire fighters in forests, exploration, providing supplies and materials for inaccessible places, rescue work, and meteorology.

The development of parachutes in Russia and their use by civilians, as well as military personnel, are given particular attention. It is stated that the Russians have made greater strides along these lines than other nations. Progress and changes in the design of parachutes and their harness and accessories are traced.

Parachutes, by Herbert S. Zim; Harcourt, Brace and Company, New York, 1942; 252 pages, $2.50.

Air-War Pictures

A collection of pictures record, in a manner that probably could not be achieved in words, some of the history of the summers of 1940 and 1941 in the countryside of southern England. Aerial combats, fallen enemy planes, airdromes of the Royal Air Force, scenes in the factories where airplanes are made and, perhaps most important, the faces of many of the men of the Royal Air Force. In these faces there appear, in the words of one of their number, "the calm confidence born in the conquest of fear and in the consciousness of absolute mastery." They are depicted not as heroes but as men who are doing and will continue to do a job well. There are portraits of pilots, squadron leaders, gunners, observers, radio operators and commodores, ranging from the Chiefs of the Air Staff to an unnamed sergeant wireless operator. It is stated in the foreword that such pictures are but a part of a larger picture not yet complete, but the book does present a section of the as yet unwritten history of Britain's air power.

War Pictures by British Artists, No. 3, R.A.F., with an introduction by H. E. Bates; Oxford University Press, London, 1942; 64 pages, 1*s.* 3*d.*

Aviation Medicine

The increasing part aviation medicine is taking in the general field of medical work in the war is indicated by the emphasis given to it in this symposium of articles that are reprinted from technical journals. Papers on cardiology, hypotension, fatigue and the effects of high altitude acquaint the general medical officer with aeromedicine. The book is evidently intended to give physicians the results and effects of recent changes which have been caused by new weapons and new war strategy.

War Medicine, edited by Winfield Scott Pugh; Philosophical Library, New York, 1942; 565 pages, $7.50.

Physics for Aircraft Students

The first of two volumes, which together are intended to comprise a complete course in physics for aeronautical students, deals with physical measurements and the properties of matter, heat, vibrations and sound. It covers the present state of knowledge of these subjects and how this knowledge is turned to practical use. While written primarily to suit the needs of students of aeronautics, it should also be helpful to those who expect to take an ordinary examination in physics. The writer has aimed at the exposition of physical principles in a manner that will enable their application to aeronautical and related studies to be readily understood. Attention has been concentrated on giving a lucid account of physical ideas and research.

The book opens with a discussion of physical measurements and the measurement of time. Part II explains the properties of matter in terms of the molecular or kinetic theory of structure. External and internal forces are discussed and also the interaction between matter and matter. Part III deals with heat and temperature. The subjects of thermal expansion, the measurement of heat, and the relations between heat and work in a gas are covered, and this naturally leads to an explanation of the second law of thermodynamics. Vibration and sound are taken up in Part IV. Here the writer goes into the wave theory and the production, reflection and detection of sound waves. The second volume of this course will deal with subatomic physics.

Mechanical Physics, by Herbert Dingle; The Ronald Press Company, New York, 1942; 248 pages, $2.25.

Mechanics' Handbook

Information and tables of value to mechanics, engineers and draftsmen is contained in this handbook. Special attention has been given to the arrangement and indexing of the text. A fully cross-referenced index is furnished to enable readers rapidly to trace the information they seek. The writer has concentrated on the incorporation of material that the reader is most likely to need in his work and has avoided giving information of little value to the majority of readers. The tabular matter is intended to cover the needs of those engaged in the mechanical trades. Some of the many subjects covered are the lathe, small tools, the micrometer, mensuration, screw and gear cutting, case hardening, the chemical coloring of metals, electroplating, silver soldering, brazing, welding, soldering aluminum, obtaining a patent, the metric system, patternmaking, battery charging, sharpening woodworkers' tools, mechanical drawing, blueprints, glues, cements and adhesives.

Practical Mechanics Handbook, by F. J. Camm; Chemical Publishing Company, New York, 1942; 392 pages, $4.00.

Meteorology Primer

This is one of a series of textbooks treating of the sciences underlying aeronautics. It is devoted to the task of introducing students to the science of meteorology. The basic principles involved in the study of the weather and its conditions are dealt with in a simple and comprehensive fashion that makes the text particularly adaptable to the needs of air force cadets and others whose interest is mainly concerned with aviation.

Meteorologic observations and instruments, variations of meteorologic factors with time of day and height above the ground, average conditions over the

globe and general circulation of the atmosphere, and the meaning of some of the observations and elementary physics of the atmosphere are all considered in detail. Other chapters present a study of the upper air; radiation in the atmosphere; water vapor in the atmosphere, condensation and precipitation; clouds and their classification; visibility, fog and mist. Attention is also directed to the plotting the observations and a primary study of the synoptic chart, the typical frontal depression, and further study of depressions and other pressure disturbances.

Weather Study, by David Brunt; The Ronald Press Company, New York, 1942; 215 pages, $2.25.

Biography of Admiral Sims

This biography will interest aeronautical circles even though only a few pages are devoted to the admiral's unorthodox opinion of the airplane. As early as March, 1922, he wrote to Admiral Fullam his conclusion: "Therefore the battleship is dead." He was convinced that the aircraft carrier was to be the capital ship of the future and that torpedoes were more dangerous than bombs. He was not a believer in the protection of antiaircraft gunfire. Even in those early days he wrote: "Any nation adequately defended by submarines and airplanes is, in my opinion, immune from attack from overseas." One of his last appearances as a proponent of the airplane was when he appeared for the defense at the trial of General Mitchell.

Admiral Sims, by Elting E. Morison; Houghton Mifflin Company, Boston, 1942; 548 pages, $5.00.

Avigation Textbook

With the increase of night flying and over-water flying, a knowledge of celestial navigation becomes increasingly essential. In wartime when radio and ground lights are uncertain in their operation such navigation by reference to stars is the only way of plotting long-range flights. This was prepared at the request of the Army Air Corps Flying Training Command to provide a textbook on astronomy, maps and the weather. The combination of subjects, while fundamentally new, is natural and gives the pilot information on the sky, the clouds and the earth as seen from above. Six chapters are given to astronomy; three, to weather, clouds and weather forecasting; several, to air navigation. The final part of the book consists of discussions of various celestial groups.

Astronomy, Maps, and Weather, by C. C. Wylie; Harper & Brothers, New York, 1942; 449 pages, $3.00.

Technical Dictionary

This most useful compilation will provide aeronautical engineers an inexpensive, exhaustive and technical dictionary which is especially complete in aeronautical terms. It was prepared by a W.P.A. project which had on loan all the definitions that had been compiled for the Aeronautical Archives of the Institute of the Aeronautical Sciences. Part 1 translates from English to German and Part 2 vice versa. As the work was done under the direction of the Chief of Staff and competent Army officers, the definitions may be regarded as standard.

Military Dictionary, by the Military Dictionary Project; United States Government Printing Office, Washington, 1941; 709 pages, $0.75.

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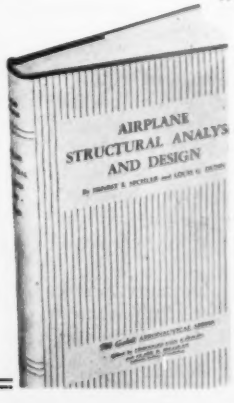

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An Early Engine

This reprint of chapters and parts of the *Langley Memoir on Mechanical Flight* describes the work of Charles M. Manly in the development of an engine for the ill-fated Langley aerodrome. After several attempts to construct an engine which would develop 12 hp. and weigh under 100 lbs., a larger engine was built. It weighed 187.47 lbs. and gave 52.4 hp. at 950 r.p.m. The greatest praise is due the pioneer for his work with aviation power plants and the book is a fitting memorial to his efforts.

The Manly Engine; Society of Automotive Engineers, New York, 1942; 254 pages, $1.50.

Outline of Aeronautics

The authors of this textbook have been teaching high-school students the outline of aeronautics for several years. They have written this book as a result of their classroom experience. The chapters are short and give the rudiments of practically every phase of aviation. A supplementary teachers' manual is available to go with the textbook. A glossary and short bibliography are at the end of the book.

Before You Fly, by Pearle Thurber Robinson, Frederic A. Middleton, George M. Rawlins, Jr., and Joseph W. Phillips; Henry Holt and Company, New York, 1942; 332 pages, $1.08.

Book Notes

Plant Production Control, by C. A. Koepke; John Wiley & Sons, Inc., New York, 1941; 509 pages, $4.00.

This is a study of the problems connected with obtaining the maximum production of goods with a minimum of confusion and expense. With the purpose of resolving the problems into functions for controlling production in any given situation, it examines methods and systems used in various factories. Each function is treated separately but is coordinated with the others to show how control is obtained. The book also traces the development of manufacturing from before the Industrial Revolution to today's highly scientific methods.

Using Better English, by Lowry C. Wimberly, Martin S. Peterson, and Grace M. Owens; The Ronald Press Company, New York, 1942; 533 pages, $3.00.

Even professional men sometimes lapse into the careless use of English. This book, in its second edition, is offered as both a reference and a manual for self-instruction. Each chapter is begun with a story that illustrates the necessity of using good English. Problems of case, agreement, reference and tense are discussed. Other chapters cover punctuation, spelling, outlaw terms, idiomatic English, and the spoken word. Exercises for the student are provided, and the appendices include a grammar dictionary and a key to the exercises.

Aircraft Identification—Part I, prepared by *The Aeroplane;* Temple Press Ltd., London, 1942; 64 pages, 2*s.*

Photographs, silhouettes, dimensions, weights, performance figures and general data are given for the 32 chief types of British-built monoplanes flying with the Royal Air Force. This booklet is intended as a basis of study for recognition of British airplanes.

Signed with Their Honour by James Aldridge; Little, Brown and Company, Boston, 1942; 392 pages, $2.50.

With air action in the Second World War as a background, this is a novel of a British Flying Officer during the campaign in Greece. Although romantic in character, it relates the story of dog fights in the air, the retreat by land and sea, and the fighting spirit of these men who were confronted by great odds.

Winged Victory, by Ariel; Basil Blackwell & Mott Ltd., Oxford, England, 1942; 32 pages.

A collection of poems by an R.A.F. flight lieutenant. All of these poems are concerned with the pilot's relationship to flying and the war.

Spitfire! by B. T. Ellan; John Murray, London, 1942; 99 pages, 5*s.*

The personal record of an English pilot's experiences with a fighter squadron. This day-to-day history of air combat over Dunkirk and in the Battle of Britain tells of the men who fought the battles and how they fought them. It also includes descriptions of routine work at night fighting and on patrol. One of the author's notable contributions is his feeling that rather than the debt being owed to the "so few," it was a privilege to be counted among them.

Defense Will Not Win the War, by W. F. Kernan; Pocket Books, Inc., New York, 1942; 116 pages, $0.25.

One of the Pocket Book series, this is an analysis of war strategy by a professional soldier who strongly advocates offensive land action as the only way toward winning the war. He makes concrete suggestions as to how and where the United Nations can attack. Mahan's theory of sea power is challenged as an oversimplification and Manila and Singapore are pointed out as lessons in the results of defensive warfare.

Fighter Pilot; B. T. Batsford Ltd., London, 1942; 122 pages, 7*s.* 6*d.*

This is a personal record of the campaign in France from September 8, 1939, to June 13, 1940, written by a squadron leader in the Royal Air Force. The narrative is based on a series of daily diary notes recorded by the pilot during his experiences. It reveals not only action that occurred, but also the caliber of the men who were doing the air fighting.

Ramparts of the Pacific, by Hallett Abend; Doubleday, Doran and Company, Inc., Garden City, N.Y., 1942; 332 pages, $3.50.

A report on the political situation in the Far East just before the United States' entrance into the war, by a veteran Far Eastern correspondent of the *New York Times.* From his travels through Hawaii, the Philippines, Malaya, Singapore, the Dutch East Indies, China, Australia and New Zealand, the author tries to give a true picture of the people who are our allies in the Pacific area and those who are our enemies. He tells of interviews with leading men in every zone, describes key defense points, and surveys the economics and strategy of what was then the approaching war.

How the Jap Army Fights, by Lt. Col. Paul W. Thompson, Lt. Col. Harold Doud and Lt. John Scofield; Penguin Books, Inc., New York, 1942; 157 pages, $0.25.

A study of Japanese military methods, fighting power and equipment by three United States Army officers. Japanese weapons are described and cognizance is taken of their peacetime preparations for war. In surveying their fighting tactics and maneuvers, the assessment of their military strategy is based upon specific campaigns in China and Malaya. The book is supplemented by several wartime editorials from *The Infantry Journal* and an appendix which includes Japanese military terms and characters.

Trade and Professional Associations of the United States, by C. J. Judkins; United States Government Printing Office, Washington, D.C., 1942; 324 pages, $0.70.

Published by the Department of Commerce, this directory lists approximately 3,100 national and interstate trade associations, grouped by business fields. It includes information on the approximate size of staff and membership of each association, as well as the principal services offered to members. It also offers indexes by cities, commodities, and secretaries.

Modern Trigonometry, by M. J. G. Hearley; The Ronald Press Company, New York, 1942; 168 pages, $1.75.

An elementary text on the numerical side of trigonometry with particular emphasis on the utilitarian nature of the subject. While the syllabus conforms with courses for school examinations, no more advanced mathematical knowledge is required for its comprehension than a knowledge of arithmetic and elementary algebraic principles. Practical questions are introduced throughout the book and a section is devoted to trigonometry's applications to astronomy, navigation and mechanics.

Aircraft Identification—Part II, prepared by *The Aeroplane;* Temple Press Ltd., London, 1942; 64 pages, 2*s*.

Prepared by *The Aeroplane*, a British publication, this is a booklet to assist in identifying German monoplanes. All the standard types of first-line operational planes are included, together with twelve of the more common older types which are still in service in numbers. The 128 photographs and 96 silhouettes are accompanied by detailed descriptions.

What's That Plane? by Walter B. Pitkin, Jr.; Penguin Books Inc., New York, 1942; 189 pages, $0.25.

A handbook containing a collection of aircraft silhouettes with a description of each. Recognition points are given on three views: the plan, front and side. Following an introduction on how to become an airplane spotter, the book is divided into information on low-wing monoplanes, mid-wing monoplanes, high-wing monoplanes, float planes and flying boats, land- and carrier-based biplanes.

Heat Transfer by Infrared Radiation in the Atmosphere, by Walter M. Elsasser; Blue Hill Meteorological Observatory, Harvard University, Milton, Mass., 1942; 107 pages, $1.25.

This monograph is No. 6 in the Harvard Meteorological Studies and includes a copy of the Atmospheric Radiation Chart. Divided into three parts, the first part of this book deals with the general theory of radiative heat transfer in the atmosphere, without regard to the particular structure of the far infrared spectrum. Part II analyzes this spectrum and shows the connection between its structural elements, which are the primary data of spectroscopy and the integral effects observed as radiative flow of heat. Part III covers the direct measurement of radiative heat flow in the atmosphere, or in the laboratory under conditions simulating those of the atmosphere, and with empirical relationships derived from such measurements.

Steels for the User, by R. T. Rolfe; Chapman and Hall Ltd., London, 1942; 356 pages, 25*s*.

This is the second edition of a book dealing primarily with carbon steels in industry. Alloy steels are not specifically covered, although they are frequently discussed in cases where carbon steels are not satisfactory for the particular duty. In this edition a new chapter covers the subject of weld testing and treatment. Additional data also are furnished concerning the heat-treatment of steel, fatigue testing and the general principles of selection.

Sea Power in the Pacific 1936–1941, by Werner B. Ellinger and Herbert Rosinski; Princeton University Press, Princeton, N.J., 1942; 80 pages, $1.00.

A multilingual bibliography of books, periodical articles, and maps from the end of the London Naval Conference to the beginning of the war in the Pacific. The references are primarily to factual information rather than political controversy, and naval strategy is emphasized in preference to political and economic problems. The bibliography is divided into three sections: The first is concerned with naval ratios and maritime power; the second, naval geography of the Pacific Ocean; and the third, the problems of sea power and naval strategy in the Pacific Area.

Winged Squadrons, by Cecil Beaton; Hutchinson & Co., Ltd., London, 1942; 47 pages, 5*s*.

Illustrated with 67 photographs taken by the famed photographer, this booklet relates his impressions of the men of the Royal Air Force and the Fleet Air Arm. His personal views are given on the way the men live and how they learn to fly, their spirit, their fitness, and their health. He depicts what it means and what it takes to become a fighter pilot, a member of a bomber crew, the Coastal Command, or the Fleet Air Arm.

Victory Lies in the Air, by Noel Pemberton-Billing; Robert Hale and Co., Ltd., London, 1942; 32 pages, 3*d*.

This booklet discusses the affirmative side of the argument that airplanes *can* win wars. It propounds the theory that bombs are more important than bayonets and that haste is a vital factor in winning this war. Unity of command is strongly urged, while the cost of bombing and the need for mass production are discussed. Part of the booklet is also devoted to a consideration of the supply of pilots, the airdromes that are needed and how they can be increased.

Only the Stars Are Neutral, by Quentin Reynolds; Random House, New York, 1942; 299 pages, $2.50.

This is the personal history of a foreign correspondent's experiences in Europe from the Spring of 1941 to Christmas of that year. Most of it is an account of what happened in Russia when the Germans invaded that country. A strong believer in Russia's ability to withstand the enemy and fight back, the author throws new light upon that nation's spirit and program.

Skywinder Mystery, by Alan Gregg; Doubleday, Doran & Company, Inc., Garden City, N.Y., 1942; 279 pages, $1.75.

A mystery novel, the plot of which revolves around a Grumman plane. The connection with aviation is purely incidental.

Diesel Vehicles, by F. J. Camm; Chemical Publishing Company, Brooklyn, N.Y., 1942; 109 pages, $2.00.

This book deals with the operation and more particularly with the maintenance and repair of Diesel engines for vehicles. It is written especially for operators of large fleets of Diesel trucks. Practical aspects of design are dealt with and the methods of diagnosing troubles are covered. A biography of Rudolph Diesel is the concluding chapter.

"So Few," by David Masters; Eyre & Spottiswoode, London, 1942; 337 pages, 7*s*. 6*d*.

A series of episodes portraying the courage and heroism of various Royal Air Force members. This record relates the exploits of aircraftsmen, sergeant-gunners, wireless operators, navigators, pilot-officers, and officers of higher rank, all of whom have won distinction for their achievements.

A Layman's Guide to Naval Strategy, by Bernard Brodie; Princeton University Press, Princeton, N.J., 1942; 291 pages, $2.50.

Intended particularly for the general reader, this book explains the fundamental principles upon which a navy operates and describes the tools and methods used. Among the most informative of its chapters is one devoted to the discussion of the role airplanes should play in naval warfare.

The Care and Operation of a Lathe; Sheldon Machine Co., Inc., Chicago, 1942; 103 pages, $0.50.

The purpose of this manual is to acquaint the beginner with the modern metal-cutting lathe, its parts and their functions. In addition to instructions on how properly to care for a lathe, it presents explanations about the grinding of cutters, the setting-up of lathe tools, methods of holding the work, and the performance of basic lathe operations.

Malta at Bay, by R. Leslie Oliver; Hutchinson & Co. Ltd., London, 1942; 108 pages, 5*s*.

An eye-witness account of the fighting at Malta and of the patience, tolerance and forbearance of the sturdy island people who have withstood more than 2,000 air attacks in that citadel of the British Empire which is said to be the "most blitzed spot on earth." The author, still a resident of the island, records facts of the everyday life of the people, the sometimes continuous air attacks, the antiaircraft barrages, and the movement of convoys and war vessels. He tells how war came to Malta overnight, catching the people unprepared. Facts are given concerning the supplies of food and fuel, the defense and the defenders and tribute is paid to the unconquered spirit of the people. In the closing chapter incidents are related to show the reactions of the Maltese to the efforts of the enemy and the manner in which they continue to carry on.

Wireless Servicing Manual, by W. T. Cocking; Iliffe & Sons Ltd., London, 1942; 300 pages, 7*s*. 6*d*.

This sixth edition of a handbook on the servicing problems connected with radio receivers is revised and enlarged. It deals with the location of defects in receiving sets as well as their correction. The choice of suitable testing gear is also discussed but no attempt is made to delve into the broader field of wireless theory.

Elementary Mathematics for Wireless Operators, by W. E. Crook; Sir Isaac Pitman & Sons, Ltd., London, 1942; 74 pages, 3*s*. 6*d*.

An outline of mathematical knowledge necessary for qualification as a radio operator. Covers applicable arithmetic, algebra, geometry, trigonometry, graphs and mechanics. In this second edition the section on elementary arithmetic is new, as is the addition of examples with answers at the end of each chapter.

Navigation and Meteorology, by D. Hay Surgeoner; Longmans, Green and Co., New York, 1942; 108 pages, $1.25.

A primer describing some of the navigational methods in current use. It also contains chapters on maps and charts, meteorology, instruments and compasses. This book is one of the Air Training Series.

Battle of the Flames, by Henry W. Stedman; Jarrolds, Publishers Limited, London, 1942; 80 pages, 1*s*.

Told by an auxiliary fireman, this is a personal story of London bombing. The work of the Auxiliary Fire Service is illustrated by descriptions of almost every major fire-blitz in the English capital.

The Avengers, by Charles Graves; Hutchinson & Co., Ltd., London, 1942; 141 pages, 7*s*. 6*d*.

The author terms his book "a real life novel of the R.A.F." Each chapter is a story of a pilot in a different operational group of fighting action. Using fictitious names of places and people the stories are made more realistic by the slang which is now so generally employed by pilots. As there is no glossary many of the words provoke a guessing contest as to their exact meaning. As a close-up picture of combat over the French and Middle East fronts *The Avengers* will be read with interest and admiration for the courage of the air fighters and bombardiers.

We Speak from the Air, issued for The Air Ministry by the Ministry of Information; His Majesty's Stationery Office, London, 1942; 72 illus., 6*d*.

This is a collection of broadcasts made by the Royal Air Force. Each one is an account of an experience encountered by an R.A.F. aircrew member while fighting in the air, as told by him over the radio.

Flare Path, by Tod Claymore; William Morrow & Company, New York, 1942; 279 pages, $2.50.

A squadron leader of the R.A.F. Coastal Patrol relates what seem to be personal experiences in flying Sunderlands and later Catalinas. Romance is present in a rivalry at the flying boat station for the love of an attractive nurse. The locating of the "Scharnhorst" by the patrol is one of the spectacular exploits of the squadron, but the tedious convoying of supply ships provides an interesting picture of the life of patrol pilots.

Bag of Smoke, by Lonzo Anderson; The Viking Press, New York, 1942; 179 pages, $2.00.

The story of the development of the balloon by the Montgolfier brothers, told for children. The author claims that 80,000 words were translated from an original French source to give a background for the account of these early attempts of man to rise into the air. The illustrations were drawn by the wife of the author and are the kind children would enjoy.

Sanabria's Airpost Catalogue; Nicolas Sanabria, Inc., New York, 1942; 897 pages, $1.50.

This standard work on air-mail stamps gives the philatelist a handy illustrated guide to all stamps issued by all countries for the carriage of letters by air. To those who are not collectors of stamps, the illustrations have an interest entirely apart from the primary purpose of their listings. They provide almost a pictorial history of aeronautics as well as a display of many types of aircraft.

Elementary Meteorology for Aviators, Part One; Longmans, Green and Co., New York, 1942; 48 pages, $0.40.

Designed to cover the British Air Training Command and Initial Training Wing syllabus, this is an introductory text on the science of weather. It deals with the atmosphere and its variables, pressure, temperature, wind and humidity, as well as some of the instruments used to measure them. In addition to an explanation of the altimeter and air-speed indicator and their uses, the book also discusses the recognition of cloud types.

The Superheterodyne Receiver, by Alfred T. Witts; Sir Isaac Pitman & Sons, Ltd., London, 1942; 200 pages, 5*s*.

Fifth edition of a book explaining the operation of superheterodyne receivers. The development, theory and modern practice of this type of wireless equipment are considered in detail. In this edition the portion of the text devoted to the maintenance of superheterodyne receivers has been revised and enlarged. Added, too, are notes on the beam triode hexode frequency changer and on the cause and prevention of frequency drift.

Library Accessions

Hell in Helmets, the Riddle of Modern Air Power, by A. G. J. Whitehouse; Jarrolds, Publishers Ltd., London, 1939; 256 pages, 8*s*. 6*d*.

Data and conjectures on the strength and strategy of the air forces of the various nations in 1939.

Simple Experiments in the Theory of Flight, by M. C. Nokes; William Heinemann, Ltd., London, 1941; 75 pages, 3*s*.

Twenty-four experiments on aerodynamic forces are illustrated and explained.

Fighter Command, by A. B. Austin; Victor Gollancz, London, 1942; 248 pages, 8*s*. 6*d*.

The story of the R.A.F. Fighter Command from the beginning of the war to the spring of 1941, by a staff officer.

Winged Words, Our Airmen Speak for Themselves; William Heinemann, Ltd., London, 1941; 261 pages, 8*s*.

Stories selected from about 150 radio broadcasts by R.A.F. officers and airmen and the W.A.A.F., between December, 1939 and February, 1941.

Les Assurances Aeriennes, by Jean Meier; International Union of Aviation Insurers, Geneva, 1939; 250 pages.

A textbook of aviation insurance with a bibliography of eight pages.

Comment Paris sera Détruit en 1936, by von Helders, translated by A. M. Hellot; Éditions Albert, Paris, 1933; 279 pages.

A translation of the German novel *Luftkrieg 1936*, which deals with a Franco-British conflict.

An A B C of Model Aircraft Construction, by C. S. Rushbrooke; Horace Marshall and Son, Ltd., London, 1941; 88 pages, 3*s*. 6*d*.

Directions for the model builder, including plans and building instructions for eleven models.

The Design of Wakefield Models, by S. B. Stubbs; Horace Marshall and Son, Ltd., London, 1941; 61 pages, 2*s*.

Based on a winning model from the Wakefield competition, the calculations in this book are worked out with the slide rule and require a knowledge of elementary mechanics for understanding.

Hydrodynamics, by Horace Lamb; Cambridge University Press, Cambridge, 1932; Sixth Edition, 738 pages, 45*s*.

The latest edition published of this standard advanced treatise.

Red Pilot, Memoirs of a Soviet Airman, by Vladimir Unishevsky, translated by Violet M. McDonald; Hurst & Blackett, London, 1939; 260 pages, 7*s*. 6*d*.

Experiences of the author as a flier and worker in Russia, written in opposition to the present régime.

The Thin Blue Line, by Charles Graves; Hutchinson & Co., London, 1940; 239 pages, 6*s*.

A documentary story of seven youths, one an American, who joined the R.A.F. and began to fight against the Luftwaffe in the summer of 1940.

Simple Aerodynamics, by A. H. Smith; Horace Marshall and Son, Ltd., London, 1941; 115 pages, 3*s*.

An illustrated beginning textbook for the aero-modeller.

The Design and Construction of Flying Model Aircraft, by D. A. Russell; Horace Marshall and Son, Ltd., London, 1940; 247 pages, 7*s*. 6*d*.

A manual for the design and performance estimation of medium- and large-sized model aircraft, both rubber and power driven.

Airmanship, a Complete Guide and Flying Course for Student Pilots Including the Operation of Aircraft in the Field, on Wheels, Skis and Floats, by John McDonough; Sir Isaac Pitman & Sons, Ltd., London, 1931; 108 pages, 7*s*. 6*d*.

A textbook for student pilots, with particular reference to flying conditions in Canada.

Gliding and Soaring; An Introduction to Motorless Flight, by Percival White and Mat White; Whittlesey House, McGraw-Hill Book Company, Inc., New York, 1931; 234 pages.

The theory and practice of soaring flight are presented, with chapters on the history, design, construction, and piloting of sailplanes, and the building of model gliders.

Avigation, by Harvey H. Holland; McGraw-Hill Book Company, Inc., New York, 1931; 272 pages.

Written as a textbook for students and a manual for pilots, this book covers the principles and methods used in dead reckoning and astronomic and radio navigation.

Ribbons and Medals; Naval, Military, Air Force and Civil, by H. Taprell Dorling; enlarged and revised edition, George Philip & Son, Ltd., London, 1940; 177 pages, 6*s*. 6*d*.

The histories and illustrated descriptions of the various awards for bravery and heroism which have been established throughout the world.

Air Navigation; Based on Principles and Methods Applicable Also to Sea Navigation, by F. G. Brown; Chapman & Hall, Ltd., London, 1941; 374 pages, 32*s*.

Essential principles and fundamentals are explained in this textbook for the use of students of astronomic navigation.

Britain Under Fire; with a foreword by J. B. Priestley; Country Life Limited, London, 1941; 96 pages, 6*s*.

This collection of photographs depicting the damage wrought by the German Luftwaffe over the British Isles is published as a record of the courage and determination of the English people during the present conflict.

"Gas!"; The Story of the Special Brigade, by C. H. Foulkes; with an Introduction by the Earl of Cavan; William Blackwood & Sons, Ltd., Edinburgh, 1936; 361 pages, 30*s*.

The organizer of the "Special Brigade" for gas warfare of the B.E.F. in the European War of 1914–1918 presents a detailed account of the role played by chemical warfare in the last war.

Gliding and Motorless Flight, by L. Howard-Flanders and C. F. Carr; second edition, Sir Isaac Pitman & Sons, Ltd., London, 1932; 145 pages.

An introduction to the design, construction and piloting of gliders is afforded by this volume written for those interested in organizing glider clubs.

Luftgefahr und Luftschutz; Mit Besonderer Berücksichtigung des Deutschen Luftschutzes, by Heinrich Hunke; Verlag von E. S. Mittler Sohn, Berlin, 1933; 190 pages.

The history and technical advances of the air arm and air defenses during the First World War and the postwar period are traced, and Germany's position with regard to defense against air attack from other European powers is outlined.

Tons against Time

Rails end . . . seas have shores . . . but cargoes sent by air go directly to destination without transhipment. For swift tonnage transport which reaches everywhere, Wright engines supply the power.

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The entire line of Boots Self-Locking Nuts is carrying out an important assignment with spectacular effectiveness in the rapidly expanding glider industry.

This is particularly true of the Boots "Cage" Nut. Specially devised for use in building planes of plywood and plastics, this recent addition to the Boots family has proved itself indispensable in attaching glider fillets and fairings, in mounting instruments to dashboards, and in many other applications requiring a positive self-locking device. The "Cage" Nut combines the familiar Boots all-metal Wing Style Nut with a special base designed to be clinched permanently into the plywood. Applying it is a *one man* operation, as it can be clinched in from *one side*. Its grip is so firm that it withstands—without tearing the plywood—the torque of bolt or screw insertion when applied by production methods.

In short, the "Cage" Nut is making possible increased substitution of plywood for vital aluminum on many aircraft applications. Remember, Boots Nuts "Outlast the Plane." Send for new catalogue today.

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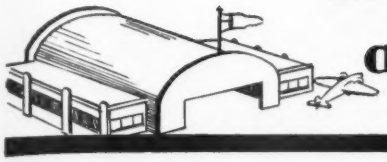

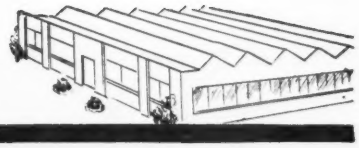

Welding Electrode Catalogue

A six-page bulletin describing in detail Ampco-Trode 10, an all-purpose, coated bronze electrode, has been issued.

The bulletin contains physical properties, chemical composition and procedures for various types of welding using the new electrode. One of the major applications for the electrode will be the metallic arc welding of cast manganese bronze, Muntz metal, and brass. Detailed instructions are given for welding metals. The bulletin is illustrated by a number of diagrams showing methods of welding, deep groove preparation, building up metal on vertical surfaces, weaving sequence, and method of depositing beds. *Ampco Metal, Inc.*, Milwaukee.

Aluminum Machinery

A new edition of a standard booklet on machining aluminum alloys is intended to conserve the metal and speed up production of parts made from it.

The booklet, *Machining Alcoa Aluminum and Its Alloys*, suggests speeds, feeds, and depths of cut which will produce satisfactory results; points out where practices and tools common to other metals may be used; and indicates where special practices or tools are desirable. Part 1 deals with general machine shop practice. Part 2 describes the practices employed in automatic screw machine operations. *Aluminum Company of America*, Pittsburgh.

Plastics Booklet

A new booklet of 24 pages defines laminated plastics and describes the various types of this material which is available to manufacturers of finished laminated plastic products. Methods of fabricating the material and some of its applications are discussed and illustrated. Tabulations set forth the physical and electrical properties of the three grades of laminated phenolic plastics, designated as paper base grades, fabric base grades and asbestos grades. *Bakelite Corporation*, New York.

Replacement Supplies

Spare Parts. Highly organized effort and efficient handling characterize the operations of the contact and production control divisions of the Bell Aircraft Corporation in cooperation with the Materiel Center of the Army Air Forces in supplying spare parts for Airacobras on battle fronts all over the world. These are the sources from which come the replacement parts that make possible the return of an Airacobra to fighting condition within a few hours after it has been damaged in action. The routine followed to maintain a flow of spare parts to the Army control depots, supply bases and front line ground crews is traced. How the planning, scheduling, production and follow-through work are accomplished is told, with illustrations of the Bell stock rooms and a brief biographic sketch of the head of that department. *The Bell-ringer*, September.

Airflow Devices

Propeller Cuffs. This article explains that the propeller cuff is a device used on Curtiss propellers to continue the airfoil section to the hub. With this cuff the air continues to flow in an uninterrupted stream to the frontal air-cooling section of the engine. *The Bladesman*, September.

Aircraft Inspectors

The Most Unpopular Man in the Plant. Austin Simonds. The writer describes some of the many duties of inspectors and tells how they perform them. Inspection operations are illustrated. *Boeing News*, August.

Plant Activities

An eight-page folder has been issued by the Canadian Car & Foundry Company Ltd., illustrating and briefly describing the plants, products and activities of this manufacturer. Aircraft illustrated include the Avro Anson trainer, Hawker Hurricane fighter, Curtiss dive bomber and a projected advanced design of transport airplane. Also shown is a 180 hp. radial engine for light trainers. It is stated that the company has under development a 3,000 hp. fuel-injection engine. Production operations on propellers produced at the company's Montreal plant are shown. *Canadian Car & Foundry Company Limited.*

Catalogue on Self-Locking Nuts

A loose-leaf, tab-indexed book containing engineering data and list prices for Boots self-locking nuts is offered. It is known as catalogue No. 275 and supersedes the previous issue, No. 270.

In this edition will be found nearly twice as many styles of nuts as have been catalogued before. Moreover, the familiar basic types have been expanded in range and improved in design, it is stated. *Boots Aircraft Nut Corporation*, New Canaan, Conn.

Airplane Inspection

O.K. for Flight. Tom Elwood. Final inspection operations on Douglas aircraft are outlined. Bombers are ready for service after this check, which is the last of the many inspection operations carried out during the manufacturing process. There is a grand total of about 12,000 inspections for each bomber turned out, it is stated. Methods of final inspection are described in some detail. *Douglas Airview*, July.

Air-Line Analysis

Air Lines and Their Post-War Future. W. A. Patterson. The president of United Air Lines presents an analysis of the present war services and future problems confronting the air transport industry. Relationships between the companies and the Government are shown to be wholly harmonious as the lines are putting forth every effort to cooperate in the war, maintaining service for the civilian population to the greatest extent possible, keeping their equipment in the best operating condition and striving to replace personnel called to the colors. It is noted that air transport is now carrying approximately 20 per cent of its potential first-class passenger traffic, 15 per cent of the first-class mail and about 1 per cent of the express.

Although route extensions are unlikely during the war and fewer air-line systems may be operating in the near future, a great expansion of domestic and transoceanic air service is visualized for the postwar period. This is especially true with respect to air cargo and private flying. It is concluded that private enterprise must take the initiative in this development, which

Safe landings through the eyes of science

That's the last hazard
Of a bombing raid . . .
After the flak
And the enemy fighters . . .
Putting your ship safely down
On the home field.

Imagine a pilot in the last war
With the weather against him.
He knows his base
Is somewhere below
Shrouded in darkness and fog
But must circle and circle his plane
In black desperation
Hoping the crash won't be too bad.

Now Uncle Sam's pilots
Can head home
And set their ships down
In weather as black as a witch's hat.

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International Telephone & Radio Manufacturing Corporation
Federal Telegraph Company

will be effective in the solution of the social problems of readjustment after the war. *The Exchangite*, July.

Early Use of Steel in Aircraft

Fleetwings Pioneered . . . . and Pioneers, in Stainless Steel . . . . . The Fleetwings BT-12 stainless-steel basic trainer is traced back to developments achieved by Fleetwings' engineers in 1931 with that material. It is stated that the company was founded in 1928 for the purpose of developing spot-welded steel assemblies for aircraft structures. The advantages of stainless-steel welding are reviewed and it is asserted that a stainless-steel wing made by Fleetwings in March, 1931, was the first application of steel to such an airplane part. Other wings and tail assemblies were made in the years that followed, until, in 1936, the building of stainless-steel airplanes on a production basis was started. *The Fleetwings' Arrow*, August.

Aircraft Panel Making

Pressing Work. How the manufacture of aircraft steel parts at the shops of General Aircraft, Ltd., has been speeded by the use of the drop-hammer method of shaping is explained. The company started using drop hammers before the War when there was some skepticism in Great Britain regarding their advantage. Now the Ministry of Aircraft Production advises this method of panel making, it is stated. Illustrations show manufacturing operations. *General Aircraft News*, July.

Electrode Holders

A 16-page illustrated bulletin (GET-1062) recently issued by the General Electric Company describes in considerable detail the progressive steps in the adjustment and operation of the atomic-hydrogen electrode holder. "Right" and "wrong" methods of adjusting the electrodes and the hydrogen supply, striking the arc, controlling the arc length and current setting, and starting the weld are described. The bulletin is designed for quick reference. *General Electric Company.*

Training Mechanics

Bantam Bombers. C. D. Goehring. In Tulsa, Okla., National Guard armory men are trained to build Douglas bombers by constructing one-third size airplanes that will never fly. Every ten weeks a bantam airplane complete in every detail except for the engine comes off the assembly line at the armory. Each completed airplane means that another group of trained men are ready to join the production line of the Douglas plants in Oklahoma. These small airplanes then are turned over to the Army where they are smashed and then repaired again by army mechanics as part of their training. *Douglas Airview*, July.

Propeller Vibration Testing

Vibration Test Unit. To measure propeller vibration in flight and the rapid variation in blade stress associated with it, specially designed equipment is necessary. The equipment used in testing Curtiss electric propellers under flight operation is described in this article. *The Bladesman*, September.

Wind-Direction Instruments

Bulletin No. 6500 was recently issued on the Gurley Selsyn-operated remote wind direction indicator. It describes the transmitter, the receiver, and a recorder which may be used to make a graphic record. Specifications are given for two models of the instrument and for combinations of wind direction and velocity indicators and recorders. Other Gurley meteorologic instruments are also shown. *W. & L. E. Gurley*, Troy, N.Y.

Airdrome Construction

Canada's Aerodrome Development. An article describing Canada's extensive airdrome construction program. The construction of airdromes for home and hemisphere defense purposes has been going on since the outbreak of the war. Illustrations show the clearing and grading of land for airdromes and an airdrome in Newfoundland especially built for Atlantic ferry service. *The Intava World*, July.

War Uses for Glues

In a four-page leaflet detailing the uses of glues and synthetic resin adhesives in the war program, a full page is given to the applications of these materials to aircraft. Eight major components of an airplane can be constructed of wood and glues, it is shown, and many other parts can be made with these materials. Government specifications for aircraft resins, plywood and glues are cited, with the statement that Laucks products meet these requirements.

Another leaflet devotes a page to a discussion of aircraft glues. Casein glues are explained and compared with synthetic resin glues. Methods of applying and testing the various types of adhesives are outlined and the durability of glue bonds is compared. *I. F. Laucks, Inc.*, Seattle.

Pyrometer Catalogue

A 57-page catalogue is presented on Micromax thermocouple pyrometers for temperature measurement and control in industry. The catalogue is known as N-33A. Specifications, descriptions and illustrations of the various models offered are shown. *Leeds & Northrup Company*, Philadelphia.

Data on Fuse Clips

A technical bulletin has been prepared on Littelfuse beryllium copper fuse clips which tells of the application of these devices in aircraft, ordnance, marine and communications service. Design and construction are outlined and dimensions and uses are tabulated. *Littelfuse Incorporated*, Chicago.

Magnetic Compass Disturbances

Off the Beam—on to the Compass. E. R. Siefkin. This article describes how errors in aircraft magnetic compasses caused by surrounding metal parts are being corrected by the Lockheed and Vega organizations. Errors due to magnetic fields surrounding electric wires can be avoided by keeping the wires far from the compass. But errors due to nearby metal parts that are slightly magnetic can only be avoided by complete demagnetization of these parts. Demagnetizing specifications have been set up and demagnetizing equipment has been installed by these companies. *The Lockheed-Vega Aircraftsman*, August.

Laminated Paper Plastics

Successful Tests on M. A. C. Plastic. Laminated paper plastic is said to have been used instead of aluminum for the fabrication of aircraft shapes. In cooperation with a large plastics manufacturer, a paper company and the Pulp and Paper Section of the Forest Products Laboratory of the U.S. Department of Agriculture, McDonnell Aircraft Corporation is reported to have applied a strong paper impregnated with phenol formaldehyde to the production of certain secondary and primary aircraft structures usually made of aluminum or steel. Among advantages claimed are lighter, cheaper production equipment, fewer structural parts, smooth finish and resistance to abrasion. *M-A-C Weekly Bulletin*, August 7.

Plant Sanitation Manual

A new, 16-page illustrated manual discusses wartime sanitary measures and cleaning routines for use in aircraft, engine and accessory manufacturing plants. Among the features of this material is its ability to destroy and neutralize a wide range of offensive odors. The manual contains recommendations for maintaining washroom floors and woodwork, wash basins, wash fountains, lockers and other facilities in a clean, odor-free sanitary condition. *Oakite Products, Inc.*, New York.

Liquid-Cooled Engine Developments

Liquid-Cooled Aircraft Engines. A description of representative liquid-cooled engines as developed to date is presented. Inherent advantages of liquid cooling as compared with air cooling are enumerated. Physical and available performance figures are tabulated on the Daimler-Benz DB.601A; Allison V-1710C-15; Rolls-Royce Merlin X; Hispano-Suiza 12Y-51 and the Junkers Jumo 211.

Comments are made on the comparative data tabulated. Design details of the Rolls-Royce Merlin, Allison and Daimler-Benz engines are presented. The power-versus-altitude development of this engine up to 1940 is described with the aid of a chart. A feature of the Daimler-Benz is the simplification of operation through the use of automatic controls. *The Intava World*, July.

Fluorescent Accessories Catalog

A new 16-page catalogue on G-E fluorescent accessories is announced by General Electric's appliance and merchandise department. Included with the catalogue is a two-page insert on the new G-E manual reset Master No Blink Starter.

The catalogue contains general and technical information on fluorescent lighting principles. It gives descriptions of the G-E fluorescent lampholders, starters, starter sockets, etc., together with detailed information on how these accessories operate, why they are necessary and how accessories of high quality contribute to the economy of operation of fluorescent lighting.

Tests made on G-E starters are described in detail regarding starting, performance, timing and radio interference. Diagrams giving mounting dimensions of G-E fluorescent lampholders are shown.

The insert on the G-E Master No Blink Starter gives information on this new starter which locks dead lamps out of the circuit and allows instant replacement. How it operates, without using current, to keep the dead lamp from flickering is explained. Illustrations on the operation of this starter are shown. *General Electric Company.*

Aero-Wheel Balancing

Facts Pertaining to Static and Dynamic Balance for Aero-Wheel Assemblies. Equipment for balancing airplane tires, tubes and wheels, both statically and dynamically, is described and illustrated in a loose-leaf booklet of seven pages.

The apparatus consists of the Manbee Aero-Wheel Balancer, which tests a wheel or a tire and tube or the complete unit in a horizontal position, and the Manbee Control Board, which contains indicating lights and a hydraulic pressure gauge to indicate the point of unbalance and the amount of weight required to attain balance. Tests for static balance and dynamic balance are described. Photographic prints are used for illustrations. *Manbee Equipment Company, Inc.*, Chicago.

Factory Trained Army Mechanics

The Army's Mechanics Are Tops. Despite the intensive training graduates of the Army Mechanics' Schools have received, the Army does not consider their training complete. Specialized training in the maintenance of specific types of aircraft is considered necessary. Army Aircraft Factory Training Detachments are being trained at field schools. The writer describes the training of students at the field school of North American Aviation, Inc. Illustrations aid in the description. *North American Skyline*, July.

Steel Handbook

A steel handbook for machine tool users has been issued by the Republic Steel Corporation. This wartime edition (No. 42) is the fifth edition to be published since 1934.

A feature of this book is the publication for the first time of the combined standard steel lists of the American Iron and Steel Institute and the Society of Automotive Engineers, Inc., for carbon

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and alloy steel bars, with suggested speeds and feeds for machining many of these grades with standard tools on automatic screw machines. Another feature is a 15-page section describing and illustrating the various cold-finishing processes and giving tolerances, size ranges, standard lengths and other information on cold-finished steel.

In addition, the revised edition contains many tables found in previous issues; these include tables giving revolutions per minute of spindles at given surface speeds for work of various diameters, drill sizes, allowances and tolerances for screws and nuts, information on tool grinding and heat treating, and stock estimating information. *Republic Steel Corporation*, Cleveland.

Air Trails

Air Trails in the Northland. The story of flights in Canada's Northland made by the first airplane bought by the Hudson Bay Company. A map shows the many trails flown by this airplane during a period of 28 months. *The Intava World*, July.

Conversion of an Industrial Empire

Ford. John Earl Davis. How the resources of the Ford organization have been converted to the production of military vehicles, aircraft engines, bombers and other war materials is narrated. A description is given of the unusual methods developed by the Ford engineers for their new tasks, of the manufacturing equipment which has been assembled, and of the training program developed for training men for the work. *Shell Progress*, August.

Calcium Chloride for Surface Bases

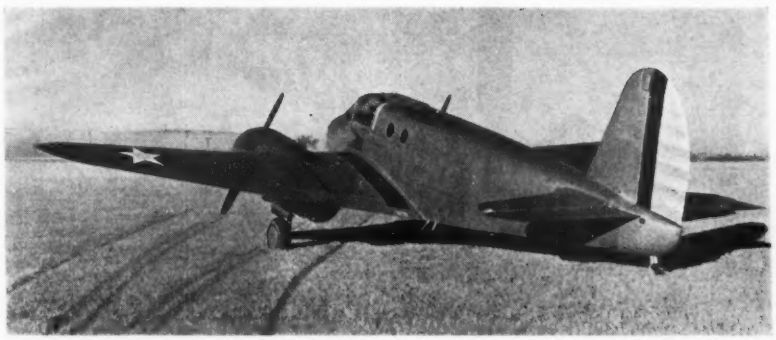
A 23-page booklet entitled *Better Bases for Better Surfaces* discusses the use of calcium chloride in the construction of graded aggregate bases. Advantages of such construction are set forth with respect to low cost, density, improved bond and reduced frost action. It is shown that the calcium chloride graded aggregate base can be used as a wearing course to carry heavy traffic without the addition of a surface. Although the information refers primarily to highway construction, it is indicated that the processes are applicable to airport runways and flight strips. *Solvay Sales Corporation*, New York.

Lathes and Lathe Work

A new catalogue (100 B), describing the entire line of South Bend engine lathes, toolroom lathes, and turret lathes, has just been published by the manufacturer. This catalogue contains 48 pages and can be filed in a standard letter size catalogue file. Each size and type of lathe is illustrated and described. Specifications are tabulated to facilitate the selection of the lathe required for any desired application. Attachments, tools, and accessories for adapting these lathes to special classes of work are also illustrated and described.

How to Cut Screw Threads in the Lathe, a 21-page booklet (Bulletin No. 36-A) covering the cutting of screw threads on back-geared screw-cutting lathes, has been reprinted. The first portion of the booklet is devoted to the setting up of a lathe for thread cutting. This includes use of quick change gear box to obtain the pitch of thread desired.

Information is given on the various types of lathe tools employed in cutting screw threads, how to grind them, and how they should be mounted and positioned. The uses of the center gauge, compound rest, thread cutting stop, thread dial indicator, taps, dies, etc., are explained. Types of screw threads commonly used are described with formulas and diagrams of standard screw thread forms. *South Bend Lathe Works.*



The Beechcraft type AT-10 Transitional Trainer (powered by two 280-hp. engines) for pilot training on multiengined equipment. The fuselage is of wood monocoque construction.

Drilvise Leaflet

A four-page leaflet describes the new Drilvise, an automatic hydraulic vise for drill press work and other operations. The tool is foot-controlled.

By foot-operated levers Drilvise gives any holding grip from contact to more than 10,000 lbs. Foot pressure moves the rear jaw forward $^3/_{16}$ in. at a time until required grip is obtained. The vise may be mounted upon a machine platen or swivel base on a machine table or bench. *Studebaker Machine Company*, Chicago.

New Handbook on Laminated Plastics

A new 56-page handbook on vulcanized fiber and phenol fiber sheets, rods, tubes and fabricated parts is available. A section is devoted to the new laminated plastic construction of aircraft parts such as wing tabs, servotabs, wing flaps, radio antennae masts, etc., and insulating parts for aircraft electrical and radio service.

Tables and other data are included to guide designing and production engineers on the selection, fabrication and application of the correct material for the purpose. *Taylor Fibre Company*, Norristown, Pa.

Wright Warcraft Engines

A four-page guide to military and naval aircraft has been prepared by Wright Aeronautical Corporation, covering current aircraft powered by Wright Engines in service of the United States Army, United States Navy and the British air forces. It lists the symbols used by each service to designate specific models and the Navy's symbols identifying the different manufacturers.

In the tabulations covering the United States war aircraft there are given the manufacturer's and Army or Navy designation, the mission for which the aircraft is intended, the Wright engine model used and the horsepower per engine. For the British planes, the information includes the type of plane and the designation of either the manufacturer or the U.S. Army or Navy, the British designation, the mission, the engine and horsepower per engine. Illustrations show the Boeing Flying Fortress, the Martin Mars, the North American B-25, the Douglas B-19, the Short Stirling, a Navy Blimp, as well as Wright Cyclone and Whirlwind engines of 9, 14 and 18 cylinders. *Wright Aeronautical Corporation.*

Inspection Equipment

An eight-page booklet entitled *Your Own Inspection Laboratory* has been brought out by the George Scherr Company. Its aim is to assist war production plants, both large and small, in the selection of equipment for the establishment of an inspection department. The booklet covers briefly the use of gauge blocks, comparators, projectors and other inspection department essentials. *George Scherr Company, Inc.*, New York.

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TIME SAVING CHARTS

For Specifying

PHENOLITE · Laminated Bakelite

The specifications charted below are the most common in use on war orders. They should be helpful to you when specifying or ordering material.

You will note the corresponding grade of PHENOLITE after each classification. If you'd like extra copies of these charts, please write us. We'll be glad to send them.

FEDERAL SPECIFICATION HH-P-256

HH-P-256 Grade		CORRESPONDING PHENOLITE GRADE		
		Sheet	Molded Tubing and Rod	Rolled Tubing
Type I	X	X-101	X-11, 12*	X-2,3,4,4-A
	P	XP-214,264	----	----
	XX	XXE-301	XX-25,26,26-A	XX-21,21-A,22,22-A
	XXP	XXP-209,259	----	----
	XXX	XXXH-401	XXX-36	----
	XXXP	XXXP-219	----	----
Type II	C	CO-501	C-45,CE-51-A	C-42
	CE	CEO-552	CE-52-A,52-B,57,57-A	----
	L	L-601,LE-651	LE-75	----
	LE	LE-653	LE-76-B,76-C	LE-62-A,63
Type IV	A	A-701	A-85	----
	AA	FAA-761	AA-87	----

*Not made in rod

NAVY SPECIFICATION 17-P-5

Navy Type	CORRESPONDING PHENOLITE GRADE		
	Sheet (s)	Molded Tubing (Tm) & Rod (R)	Rolled Tubing (Tr)
PBE	XXXH-401	XXX-36	----
PBP	XP-214,264	----	----
PBG	XXE-301	XX-26	XX-22,22-A
PBH	A-701	A-85	----
PBM	X-101	X-12***	X-3,4-A
FBE	CEO-563-N	CE-52-A	----
FBG	CEO-552	CE-57	----
FBH	FAA-761	AA-87	----
FBI	LE-651-K	LE-76-B	----
FBM	CEO-551* CO-501**	C-45	----

*Less than 1" thick **Over 1" thick ***Not made in rod

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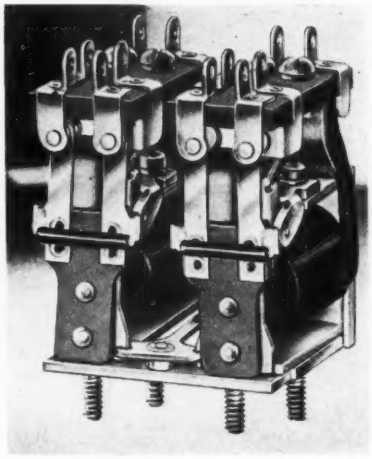
From the Industry

Allied Control Company

To keep pace with the rapidly expanding requirements of the aircraft industry for relay control devices the Allied Control Company recently introduced a new BJU aircraft relay. A feature of this instrument is that it locks mechanically in either position so that only momentary current needs to be applied to the coils. The relay is of the four-pole, double-throw type, with maximum rating of 5 amp. per contact. It is noninductive and is available for alternating or direct current.

The BJU relay is said to meet all Army, Navy or C.A.A. specifications. Dimensions are 1 by 1 by 2 in. and the weight is 7 oz.



The new BJU Aircraft Relay.

Boeing Aircraft Company

It is reported that nearly 100,000 special tools of all kinds and classifications have been designed and built since the beginning of the national emergency by Boeing Aircraft Company. The 100,000 figure does not include standard types of tools purchased, such as electric motors, drilling motors, pneumatic hammers, riveting machines, die sets, or large presses, dies, machines or countless other tools used in production of the Boeing B-17F. Including these, the total would be almost doubled.

The largest of the tools made by Boeing are the three-story high wing jigs. More impressive than the size of the jigs, however, is the fact that these jigs contain ample working room for large crews of workers on each floor or story, with plenty of light and ventilation for the workers. The jigs can be partially dismantled to remove the completed wing and reset in a brief time. Adjustments on the jigs enable the Boeing inspectors to check the accuracy of the jigs to limits of 0.0005 in. The smallest of the tools are grommets which are used to hold together the longitudinal and circumferential stiffeners of the Flying Fortress fuselage while riveting is started.

Boeing's "Octopus," a circumferential hydropunch, performs 19 different punching operations at one time, making "V"-type slots in the circumferential stiffeners that encircle the fuselage of the Flying Fortress. This machine, turning out work 45 times as rapidly as the machine which it replaces, is now also being used by the Douglas Aircraft Company and Vega Aircraft Corporation.

The automatic aluminum spot-welding table is another tooling development at Boeing. This machine, performing 62 automatic spot welds each minute, travels $1/2$ in. at fraction of a second intervals, pausing for 0.8 sec. for each weld. The machine makes big sheets of aluminum from small ones and is now being used by other aircraft manufacturers to speed up their production.

Boeing's tooling department is so organized that it can have a new die in operation manufacturing parts within two weeks of receipt of a change request. About one week is required for the designing of the die, the other week for making it. Instead of using a hard die steel, Boeing makes many of its dies from Kirksite, a special zinc base metal which can be melted in the foundry and cast. First, a plaster and wood mockup of the die is made to shrink scale. A plaster mold is made from the mockup, the mold is covered with a lacquer, a plaster pattern is made from the mold, the pattern goes into the foundry and is packed in casting sand, the pattern is removed, and the die is cast. When cool, the die needs a little polishing to remove the rough marks of the sand and is ready for use after being checked for accuracy. This die process is particularly adapted to the aircraft industry, since it is seldom necessary to make more than 5,000 or 10,000 parts from a single die.

How this method works is evidenced by the tail gunner's door. The door to the rear gunner's compartment of the Flying Fortress, as it was first built, required a jig and over 30 parts, which were assembled by riveting and spot welding. When a die for a draw and form operation was made for this job, 26 parts, along with numerous rivets, were eliminated and a considerable saving in time was effected by not having to assemble the door.

One of Boeing's accomplishments was learning how to retard the action of heat-treating dural. After a part was made on a form die, it had to be heat-treated to provide additional strength. Heat-treating causes the metal to warp somewhat, making the pattern out of true. Boeing's method requires putting the heat-treated metal on dry ice after heat-treating. The period of setting up consequently is retarded as long as the metal is kept at a sub-zero temperature. Removed from dry ice, the heat-treated parts are put on a restrike die that restores them to their original shape, and shortly thereafter the heat-treat sets up to maximum strength.

Boots Aircraft Nut Corporation

Boots Aircraft Nut Corporation's floating anchor nut is a combination of the regularly available channel nut with a specially designed base. By this means the channel nut may be used for specific anchor nut application where "float" accommodation is desirable. The nut may be snapped in and out of the base just as it may be snapped from the regular gang channel.

Floating one-lug two-rivet nuts, floating right-angle nuts, and floating plain anchor nuts are available, and in all cases the base will be finished with regular rivet holes, with dimpled countersunk rivet holes, or with plain welding base as desired. Government authorities are said to have approved the use of Boots floating anchor nuts for welding because the nuts are removable.

The floating nuts—made of cadmium-plated steel, anodized aluminum, or

stainless steel—are both plain and countersunk 82 and 100 per cent.

Carboloy Company, Inc.

To further expedite delivery and reduce costs of carbide boring tools, Carboloy Company, Inc., has standardized such tools in both solid Carboloy and Carboloy-tipped styles and is placing the complete standard line in mass production similar to the standard line of Carboloy facing and turning tools.

The standard boring tools are being made available in sizes ranging from $^3/_{32}$ to $^1/_4$ in. diameters in the solid Carboloy form and in diameters ranging from $^5/_{16}$ to $^1/_2$ in. for the tipped types.

Both solid and tipped types will be furnished cylindrically ground to a tolerance of +0.000 to −0.001 in. with cutting edges unground. This will permit the user to grind cutting edges to suit specific jobs.

In this manner it will be possible for users of boring tools to reduce inventory on Carboloy boring tools, since it will not be necessary to maintain separate tool reserves for each differently shaped boring tool required.

The line comprises six sizes of solid Carboloy boring bits and four sizes of tipped tools, with each of the latter available in the two styles described. Tipped tools have a shank length of 2 in. for the $^5/_{16}$ and $^3/_8$ diameter sizes, while larger sizes have a shank length of $2^1/_2$ in.

Clutsom Machines Incorporated

The Pratt grinding gauge is claimed to increase output and reduce operating costs, in many cases more than 50 per cent. It also practically eliminates the possibility of rejects in cylindrical grinding on diameters of $^5/_{16}$ in. upward, since it provides an always visible reading while reduction of diameter progresses.

This gauge makes it unnecessary to stop a machine to measure the stock by means of calipers or micrometers. Polished diamond contact points in the Pratt gauge are claimed to stand long and hard use without wear and will not scratch the piece being ground. The gauge itself detects rough grinding and chatter.

Despatch Oven Company

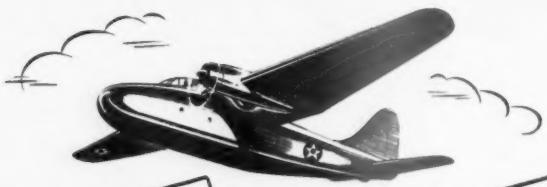
Setting new speed records for heat-treating aluminum castings, a Cincinnati plant reports that 8,000 lbs. of castings are quenched in 25 sec. using a recently installed Despatch aluminum heat-treating furnace. This installation with its particular material-handling features is believed to be the first of its kind.

Rapid handling of castings is made possible by use of two load platforms of structural steel; these are pulled by an air-operated winch over a series of rollers that form a continuous roadway from loading section and across the quench tank into the furnace chamber.

After a load has been processed in the furnace, it is withdrawn and dropped by elevator into the quench bath. The waiting raw load is then pulled immediately into the furnace, passing directly over the quench bath on the rollers provided on top of the quench cage. Later, the quenched load is raised from the bath and smoothly withdrawn over another series of rollers on the bottom of the quench cage. Thus there is always a clear track from loading section to furnace, whether the quench cage is up or down.

Heat uniformity of ±5° F. is claimed for the furnace work chamber, which permits combined horizontal and vertical heat flow. An indirect gas heater is used with nine alloy return bend radiant tubes (convection heat) to allow processing of all types of aluminum or magnesium. The fan is of alloy steel, with a capacity of 20,000 cu.ft. per min., and an automatic temperature control is provided.

4 GLUES FOR FASTER WOOD PLANE ASSEMBLY



CASCOPHEN LT-50
Phenol resin. Sets in 8 hours at warm storage (140° F.). Quick set in heated assembly press.

CASCAMITE ANS
Urea resin. For cold or hot press assembly gluing. Bonds quickly at 240° F.

CASCAMITE BG-2
Urea resin. Produces boiling-water-resistant bond when hot pressed. Liquid glue can be applied one day, pressed the next — or later. Bonds quickly at 220° F.

CASCO AIRCRAFT JOINT P
Casein glue. The standard since 1917; now improved in durability by special mold inhibitor. Safe to use over a wide temperature range and under difficult gluing conditons.

● One or more of these four glues fits every wood airplane assembly need. Samples, detailed instructions and service by men who specialize exclusively in glue—are yours on request.

SEND FOR THESE NEW BULLETINS:

Chart, "Wood Glues for Aircraft Manufacture"—Describes 5 phenol resin, 7 urea resin, 1 casein glue. Covers every plywood, assembly and bag gluing need.

Technical Bulletin 103—Describes 3 cold and hot setting urea resin glues, relating them to Army-Navy Specification AN-G-8.

Address: Casein Company of America, Dept. AER 1042, 350 Madison Avenue, New York, N. Y.

CASEIN COMPANY OF AMERICA
Aircraft Glues
DIVISION OF THE BORDEN COMPANY

General Electric Company

Two newly designed ignition-booster coils for aircraft engines have been introduced by the General Electric Company. These coils—one for use on 12-volt circuits, the other for 24-volt circuits—are designed to comply with U.S. Army Air Forces specifications. The booster coil is claimed to provide ample and positive spark for starting aircraft engines at low magneto speeds. The booster operates only at starting and is then cut out of the ignition circuit. One booster coil per magneto is required.

The housing of the booster coil is constructed of a specially developed material that provides extra insulating strength and high resistance to arc-over. The booster coil operates successfully under a wide range of ambient temperatures—from −70° to +200°F.

A new autotransformer developed by the same company permits control-tower regulation of runway and contact lights to any one of five degrees of brightness, thus making it easy to reduce the range at which an airport can be spotted by enemy planes and yet supply enough light for incoming friendly planes.

With the new 5-tap transformer, 100, 30, 10, 3, or 1 per cent of normal brightness can be obtained. The autotransformer is energized by a standard Novalux series constant-current transformer. By means of remotely operated tap-changing switches the constant current supplied to the autotransformer can be reduced to the predetermined current value corresponding to the brightness desired.

Three new ballasts have been developed by the General Electric Company for fluorescent lighting in aircraft. They will operate efficiently at any altitude when suitable ventilation is provided.

The first is a new combination ballast and transformer for fluorescent lighting of aircraft instruments and indicators. It will operate four 4-watt Mazda F lamps and it will also provide a 3-volt, 10-amp. power supply for operating aircraft indicators and rim lights—such as the 0.19-amp., 3-volt T-1¼ lamp—from a 400-cycle, 110-volt supply.

The second is a new enclosed, high-power-factor ballast available in three types, specially designed for fluorescent lighting of aircraft cabins. This ballast is constructed with built-in Pyranol capacitors. The capacitors provide a high-power factor—above 95 per cent—which reduces the weight of the wiring required to carry power to the lamps. Cat. Nos. 58G946 and 58G947 are single-lamp ballasts and operate one 15-watt and one 20-watt Mazda F lamp, respectively. They operate from either a 400-cycle, 115-volt, single-phase generator power supply or from the line-to-neutral (117 volts) of a 400-cycle, 203-volt, three-phase, generator supply. Cat. No. 58G949 is a two-multiple lamp ballast for operating two 30-watt Mazda F lamps from a 400-cycle, 203-volt, three-phase generator.

The third is a new core-and-coil ballast available in two types designed for use where mounting space is very limited. This is a single-lamp, uncorrected-power-factor ballast. The ballast weighs only 4¼ oz. and measures only 2½ by 1½ by 1¼ in. Cat. No. 58G928 will operate one 15-watt Mazda F lamp, and Cat. No. 58G929 will operate one 20-watt Mazda F lamp.

Sodium light is being used in several important war plants for surface inspection by microscope because of its efficiency in the detection of pits, cracks and flaws in materials. The unusual perception of detail under sodium illumination is due to the monochromatic nature of the light. The eye, in common with other lenses, actually focuses only one narrow wave or color band at a time. Other colors in the beam tend to fog the picture. Thus, minute details may be lost in examining an object under a light that contains all wave bands in contrast to an examination of the same object under monochromatic light that contains only one wave length.

Monochromatic light for microscopic inspection is most effective when spread uniformly over a large area rather than concentrated in small bright patches. In this way an undistorted view of both size and shape of flaws present is obtained. For most effective results, the level of the illumination should be comparatively high, especially when the contrast between flaw and surrounding material is low.

It is helpful in searching for cracks and blowholes to treat the part with either a light-absorbing or light-reflecting dye, the dye depending on the nature of the surface to be inspected. The dyed surface should be cleaned thoroughly before inspection. This procedure increases the contrast between flaw and object to the point where many times smaller flaws can be detected. In all cases it has been found necessary to block out as much sunlight as possible in order not to destroy the monochromatic nature of the sodium illumination.

Goodyear Aircraft Corporation

Movable scaffolding, made in sections and mounted on swiveled casters, is speeding up the assembly of Navy airships at the Goodyear Airship base in Akron.

As a new airship fuselage is delivered to the assembly room, the four scaffolds are rolled into place, completely surrounding the car. A small trigger, tripped at the caster wheels, holds them firmly in position. The scaffolding gives the assembly crew a good working position as they proceed to float the helium-filled bag over the car, make it fast, and start the processes needed to deliver a completed airship. The scaffolding is adjustable for height so that men get at all parts of the airship.

Once the blimp is finished and ready for its trial flight, the scaffolding is unlocked and rolled off to one side, ready for the next job. Formerly, wooden scaffolding had to be built and torn down four times during the assembly process.

Harvill Corporation

Unusual time- and material-saving methods have been used by the hydraulic division of the Harvill Corporation, Los Angeles, in the production of standard three-way plug valves of the type used in military airplanes. The function of such valves is to control the directional flow of hydraulic fluid to such apparatus as the automatic pilots. The valves are placed in the pressure line ahead of the equipment to be operated by the hydraulic fluid.

Formerly produced from forged stock with a great number of hand and automatic screw machine operations necessary, the Harvill plug valve is produced by the pressure mold casting process. Even such parts as the screw plug in the end of the valve are produced by this method, with only thread-milling operations necessary on the casting prior to installation. Principal advantages of the Harvill pressure mold process of making the plug valves are the elimination of approximately 83 per cent of the machine tool time required to make each valve and over 50 per cent reduction in the materials required for the valves. Aside from small shavings from the threading operations and the surfacing of the manganese bronze plug, there is full utilization of the raw materials.

Aluminum alloy 13-X is used for all parts except the plug, which is pressure mold cast from manganese bronze. Many of the parts are ready for assembly when delivered from the pressure mold casting department. The Harvill three-way plug valves are now in large-scale production and are available in several styles and sizes.

The Indium Corporation of America

The need for conservation of tin in the usual lead-tin solders has caused

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"Knowhow" proof #2
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Yes—"know how" is just so many words until you see proof. So, here's another of the many tough war production jobs licked by Scovill—a close tolerance, vital part.

The part shown was originally a 3-piece job—aluminum plate—brass hex nut—brass screw machine part—plus a staking operation. But Scovill "know how" produced it in one piece in aluminum by heading, several cold forging operations, threading and slotting. Important metal, money and motions were saved.

You may have a screw products war production problem as tough or tougher. If so, Scovill "savvy" is probably the best answer. *And here's another important point to remember*—the same skill and ingenuity go into all Scovill *standard* screw products. It is your *tested* proof of screw products that are *okay* in *every* way. Don't take chances on war jobs—take Scovill!

TO MEN WHO ARE LOOKING AHEAD!

We're in war work up to the hilt. Uncle Sam and his suppliers have first call. But we want to work with you on your post-war screw products plans. Call us in. We'll either give you A-1 immediate service, or a *prompt*, frank picture of our current situation. You'll receive the service and treatment we ourselves would want.

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extensive research to be done on the lead-silver solders, which have been known for many years but which have not enjoyed wide use because of their relatively high melting point and poor spreading qualities. To these solders various metals have been added in an attempt to overcome these disadvantages and these tests have met with varying degrees of success.

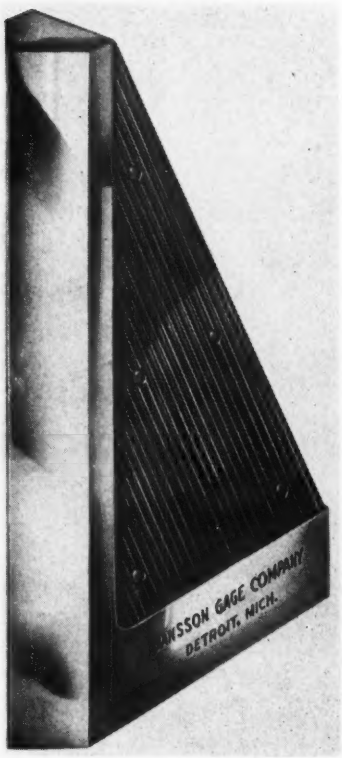
While undoubtedly much greater success could have been achieved by using various percentages of tin, because of the importance of conserving tin the Indium Corporation has carried on its experimental work eliminating tin entirely. A report made by The Electrical Testing Laboratory of New York City on direct comparison of samples of 97 per cent lead and 3 per cent silver solders with samples of 96 per cent lead, 3 per cent silver, 1 per cent indium and 95 per cent lead, 3 per cent silver and 2 per cent indium shows that additions of such small percentages of indium to silver-lead solders materially improve the coverage, spreadability and bonding strength of such solders. A sample containing 1 per cent indium is said to have reached a maximum breaking load of 1,575 lbs. in three tests and averaged 2,900 lbs. per sq.in. holding strength, compared with 1,600 lbs. and 3,900 lbs. per sq. in., respectively, for a sample containing 2 per cent indium. A sample containing no indium reached a maximum breaking load of 975 lbs. in four tests and average holding strength of 1,710 lbs. per sq.in.

Jansson Gage Company

A Master Tri-Square, operating within exceptionally close limits, has just been produced by the Jansson Gage Company, Detroit. Of one-piece solid construction, it is suited to extreme precision measurement wherever 90° angles are involved. Held to limits of 0.00002 in. base and side, the Master Tri-Square is available in two sizes: 4 in. in height with a $^5/_8$ in. wide standing base and 6 in. with a 1 in. wide base.

The Master Tri-Square is hardened, ground and lapped from alloy tool steel, final manufacturing operations being done in a special temperature control room to assure maximum gauging accuracy. It is provided with an inset hard fiber serrated grip to prevent heat transference and to guard against slipping in handling which might cause damage to the instrument. Vertical side edge is knife-sharp for truer visual gauging.

The Master Tri-Square is a basic gauge for inspection departments. It is used in laying out and checking right-angle work and square surfaces and in checking V's, straight flat edges, and parallelism of cylindrical surfaces.



The Jansson Master Tri-Square.

The Lincoln Electric Company

A new electrode, designated as "Fleetweld 11," has been created expressly for use with the "Fleet-Fillet" technique of arc welding.

"Fleetweld 11" is not only a fast-flowing electrode but it is said to give deeper penetration of metal into the root of the joint. It is of shielded arc type and heavily coated to exclude oxides and nitrides from the weld. In demonstration, the new electrode welded in 35 sec. a joint that required 1 min. and 17 sec. to weld with conventional electrodes and ordinary procedure.

High currents are used, the electrode is advanced at a higher speed, and the weld metal penetrates into the corners where the two pieces of metal are joined. The electrode is held at an angle of 45° to 60° with the horizontal plate and 90° with the electrode path along the joint. The arc produced is so short that the electrode coating practically touches the metal.

Designed to complete a weld in one pass, "Fleetweld 11" is made in 18 in. lengths and two diameters, $^3/_{16}$ in. and $^1/_4$ in., packed in 50-lb. cans.

Malabar Machine Company

The horizontal load capacity of Malabar V-H Aviation Jacks with ram fully extended is based on a minimum of 15 per cent of the vertical working load of the Jack. This is intended to provide maximum stability while checking retractable landing gear, changing wheels or tires, etc., as well as stability against wind stress.

Tripods of Malabar V-H Jacks are equipped with leg sections that can be quickly lengthened or shortened as the needs arise. One set of Malabar V-H Jacks of a given capacity will service a wide variety of airplane types.

Three sets of leg sections, 18 in., 36 in. and 54 in. in vertical height, are standard equipment to afford increased heights.

An adaptable screw extension 16 in. in length is fitted into the head of the ram. This provides quick adjustment up to 16 in. upward at any tripod height without changing to longer leg sections.

To fit the individual designs of jack points on different airplanes the maker furnishes special adapters. These fit over or screw onto the adaptable screw extensions.

The Glenn L. Martin Company

A major difficulty in the riveting of aluminum "skins" over spars and ribs to make wings has always been the unavoidable wrinkling and buckling of the skins under the pounding of riveting hammers. The wrinkling and buckling, even though slight, interfere with the smooth flow of air over and under the wing. This impairs the efficiency of the wing and thus of the whole airplane.

The system of "heat therapy" devised at the Martin plant solves that difficulty by expanding, then shrinking, the skin on the wing. The new process also greatly simplifies and speeds the wing-covering operation.

The various sheets of aluminum that make up a skin are riveted together on a wood frame that has the shape of the wing. The skin, full of unavoidable small buckles and wrinkles, is then laid on the wing of the plane. The skin heater, which might be described as an oversized version of the electric heating pad, is laid on top of the skin. The heater fits snugly, for it has the exact contour of the wing.

The heat is turned on. In a few minutes the skin has a temperature of 140°, which causes enough expansion to rid it of all wrinkles and buckles. While rheostats hold the temperature constant, the skin is quickly stitch-riveted round the edges and along the ribs. Then the heater is removed and the skin shrinks taut and unwrinkled.

Northrop Aircraft, Inc.

Culminating research over a two-year period, Northrop Aircraft, Inc., is introducing and giving to the war industries "Heliarc" welding. This new development permits the arc

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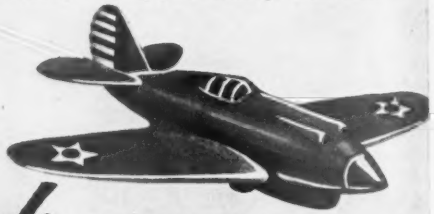
Investigate **NOW** for the future by sending for a brochure picturing our complete facilities to be available **AFTER VICTORY.** Joseph J. Cheney, President.



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welding of magnesium sheets, extrusions and tubing into structures said to be simpler, lighter, and stiffer than is possible in conventional construction. At the same time, methods of treating magnesium to make it less inflammable and more resistant to heat have been perfected. With the properties of magnesium alloys, together with the rapid production method of attachment and aerodynamic advantages which Heliarc welding is claimed to present, the future use of magnesium alloys for the fabrication of structures, especially in aircraft, is expected to be enhanced.

Magnesium castings containing foundry defects have been repaired with this process, and welds equal to or stronger than the surrounding metal have been obtained. The weld metal is more dense than that of the surrounding cast metal and less susceptible to corrosion. Almost any thickness of cast metal that can be poured may be readily welded with this process.

Welding rod of the same alloy as the parent metal is usually used for castings and wrought alloys. The weld ingot appears to have better corrosion-resistant properties than the parent metal in salt spray tests. The weld bead appears to be cathodic to the adjoining metal, which causes minor pitting of the original metal adjacent to the weld under severely corrosive conditions.

The tungsten electrode is slowly alloyed with the weld metal and naturally in a period of time the tungsten electrode must be replaced. No noticeable increase in the corrosion rate of Heliarc welds in magnesium alloys because of the presence of tungsten has been noticed.

Heliarc weld ingots have in general a fine grain with practically no grain enlargement adjacent to the bead, indicating that there is a minimum of heating effects on the adjacent metal.

Dowmetal J-IH magnesium alloy, Heliarc welded, has approximately 95 per cent of the parent metal strength in the weld area. However, at present the design safety factor for welded Dowmetal J-IH assemblies is 75 per cent of the strength of the parent metal. These strength values are based on butt-welded joints. Fillet, lap, edge, or corner welds are weaker than the butt-welded joint and must be stressed accordingly.

Heliarc welding is said to be a successful medium of attachment for magnesium, stainless steel, brass, Inconel, Monel, and some of the carbon-steel alloys. Research work is now in progress to extend its use to aluminum and other carbon-steel alloys not heretofore Heliarc welded. In the Heliarc welding process, a shield of helium gas envelops the molten metal. Because helium is an inert gas, it prevents oxidation and eliminates the use of a flux and the danger of entrapped flux in the weld ingot that would promote corrosion. The arc in this process is produced directly between a tungsten electrode and the base metal rather than between two tungsten electrodes as is the practice in atomic hydrogen welding.

The Northrop process of Heliarc welding of magnesium.

In the Heliarc welding of magnesium structures a tungsten electrode is used with reversed polarity making the magnesium the anode. For ferrous and copper alloys, a carbon electrode is used and the welded structure is the cathode. Craters are eliminated in reverse polarity welding.

Precision Paper Tube Company

Higher corrosion resistance in bobbins for coil windings is reported to have been achieved by Precision Paper Tube Company, Chicago, by construction in which cellulose acetate is embodied in the bobbins.

Cellulose acetate is used in combination with the spiral-wound dielectric fish-paper core and vulcanized fiber flanges. Spiral wound laminations of cellulose acetate are made over a die to the outside diameter of the core and then with a press-fit slipped over the core to form a spacing tube. The length of the acetate determines the winding area. The inside faces of the fiber flanges are laminated with cellulose acetate before die-cutting, then the core is swaged, locking the flanges in place onto the core carrying the spacing tube. Acetate cement is brushed over the joinings to give complete protection and to strengthen materially the bobbin.

Uses of this form of coil bobbin are wide—instruments and equipment on aircraft, ordnance, marine services and all uses in which coils are subject to corrosion due to temperature and climatic changes. Precision bobbins with this improvement are furnished in all forms—round, square, rectangular, and special shapes to fit engineering conditions.

Ryan Aeronautical Company

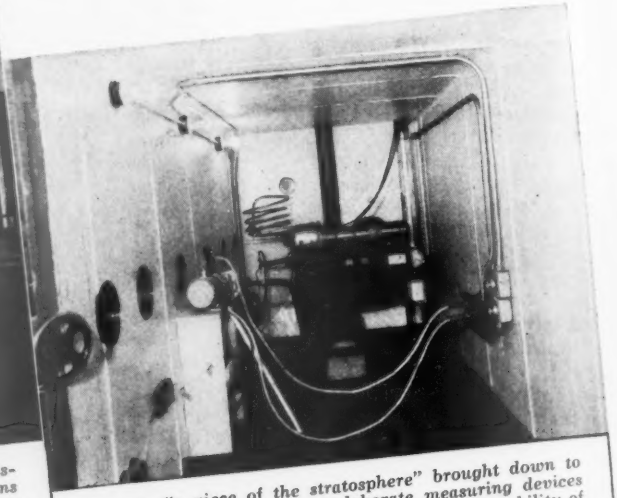
On contract for the U.S. Army, the Ryan Aeronautical Company has completed a new plastic-bonded plywood military primary trainer that is believed to approach the goal of almost complete elimination of strategic materials in military aircraft.

Aluminum alloys and all strategic materials have been eliminated in the new Ryan ST-4, with the exception of the engine cowling, which represents less than 2 per cent of the total weight of the airplane. No forgings, castings or extrusions, or critical steels are used for any of the fittings or structural parts.

The Ryan company has made use of its wide experience as a builder of training and sport planes. The wing design is based on the tapered wing construction used in the Ryan model S-C cabin plane. Like the S-C wing, the wing of the new plywood trainer embodies different airfoils at the root and the tip, and use is made of "washout" to eliminate the unfavorable stall

WE MUST KNOW HOW SOUTH WIND HEATERS Will Perform At 15,000 - 30,000 - 45,000 Feet!

Through these port-holes and on these recording and measuring devices, our laboratory engineers learn what happens when South Wind Heaters are put through their paces under high altitude conditions.



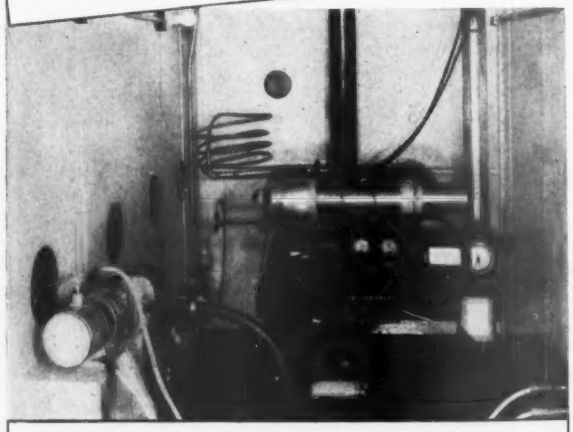
Here, in "a piece of the stratosphere" brought down to ground level, sensitive and elaborate measuring devices which could not be taken aloft prove the serviceability of South Wind Heaters.

FACTS Are More Important than THEORIES, in Our Book!

STEWART-WARNER South Wind Heaters for aircraft have behind them the best of engineering skill, the finest of theory. But their role is vital. Theory is not enough. They must demonstrate PROVEN PERFORMANCE before they are released for use in combat, bomber, and other planes of our country's air forces.

How to prove performance? Take it up and see if it works? Not so simple as that! Planes are needed for other jobs. And elaborate recording and measuring equipment is bulky. Furthermore, the testing must be done under controlled conditions—difficult to do aloft.

So, in order to make the final flight test merely a routine check-up, we "brought the stratosphere down to the heater." We designed and built the altitude chamber pictured here. It simulates altitudes beyond the capabilities of any plane . . . altitude pressures encountered at 15,000—30,000—45,000 feet and beyond. So now we KNOW what these heaters will do—such as the heater which operates *without supercharging at 48,000 feet!* Theory said "yes,"—and the altitude chamber *proved it!*



Heat transfer coefficients, heat output, ability to keep fliers and equipment at maximum-efficiency temperature under varying altitude conditions—these are vital questions answered by the altitude chamber.

This chamber and its accessory instruments are typical of the care and equipment which produce and prove Stewart-Warner South Wind Hermetic Combustion Heaters!

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South Wind HERMETIC COMBUSTION **Heaters**

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HEATER DIVISION, STEWART-WARNER CORP., CHICAGO

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features characteristic of some tapered-wing designs. In addition, the ST-4 has acquired from the S-C the Ryan center-section perforated "air brake" as a drag-increasing device for small-field operation.

The monocoque stressed-skin fuselage makes use of ten bulkheads formed of laminated spruce and is plywood covered. In cross section it has a wide, curved bottom (nearly flat) tapering to a more sharply rounded upper section. Wings meet the fuselage at 90°. Reinforcement is obtained at the cockpit cutouts through the use of heavy wooden longitudinal members extending from forward of the front cockpit to the rear of the rear cockpit. Straight lines are used in the center portion of the fuselage and in the tail cone, completely eliminating double curved surfaces.

The main bulkhead, No. 3, is made in three parts and is slotted in the lower half to receive the center-wing spar. No. 2 bulkhead uses black walnut inserts for every other lamination, as this bulkhead carries the torque tube which joins the leading edges of the outer wing panels. No. 1 bulkhead has black walnut plates at the four engine-mount points, and the engine-mount fitting makes use of a split longeron to carry the engine load back through the fuselage.

A geodetic fuselage jig instead of the usual beam type jig was perfected by the Ryan plant to speed up production of the fuselage sections. This makes it possible for a workman to go inside the jig to unbolt the holding forms after fabrication, so that all that is then necessary is to slide the completed section off the jig.

The full cantilever wings have a two-to-one taper ratio and a 5° dihedral and employ different N.A.C.A. airfoils at the root and at the tip. A monospar wooden center section is used. The two outer panels have removable tips for ease of repair, maintenance and replacement. Each panel is built up from a single wood spar with wood ribs and a plywood-covered nose torque box, with fabric covering the entire panel. In this respect it is the Ryan S-C wing, with wooden materials substituted throughout for metal. This type of construction makes possible a wing that has its natural center of gravity coinciding with the center of pressure and tends to eliminate the probability of wing flutter. Spars taper in depth from root to tip. Root ends of spars are reinforced with hardwood blocks at the center-section juncture and are attached at four points at the root of the spar and one at the leading edge. Walkways are located on both inboard portions of the center section and are adequately reinforced. All ribs, spar flanges and spar assemblies are brought to size from contour templates by means of routers and shapers, thus eliminating hand finish work.

The fixed surfaces—stabilizer and fin—are fabricated from wood spars and wood ribs and are plywood covered. The rudder, elevator and ailerons are made from wood spars and ribs and are fabric covered. The center section flap utilizes a wood spar and ribs with plywood cover.

Little special equipment is required in building the new Ryan plywood trainer as cold-setting urea formaldehyde glues are used. The only molded plywood section is the leading edge of the outer wing panel. Standard size flat plywood sheets are employed for all other parts of the airplane and, since all shaping of the fuselage and other units is done over large radii, no complex forms are required for fabrication. The phenol formaldehyde resin-bonded processes enter into the manufacture of the Ryan plywood trainer only indirectly, since this work is done by the supplier of the flat plywood sheet. Lamination is featured throughout the airplane in detailed parts including rib cap strips, spars and fuselage bulkheads.

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Engineering Review.

Sciaky Brothers

A radial-type gun spot welder, Model P-1-R, is now being offered by Sciaky Brothers, Chicago, in both stationary and buggy-mounted units. It is equipped with a special welding timer and operates on single-phase alternating current of 220 or 440 volts. Hydraulic pressure is supplied by a hydropneumatic booster, which can feed a gun able to supply a maximum electrode pressure of 1,800 lbs. with 90 lbs. per sq.in. of air supply.

Fixed or crowded jigs can be reached with the portable buggy-mounted welding gun. The maximum area reached by the stationary unit is represented by a circle of 21 ft. diameter.

Secondary cables are thin, flexible and short; the reduction in the usual size of secondary cables is made possible because of the use of fixed heavy copper bars (water-cooled) in the length of the secondary circuit.

In steady production conditions, this welder is said to be capable of welding corrosion-resisting steel, pickled steel, zinc-coated steel and Monel metal in thicknesses of from 0.016 in. plus 0.016 in. up to 0.064 in. plus 0.064 in. It is claimed that the unit will also weld two unequal thicknesses up to a total welded thickness of 0.500 in., provided that one of the two thicknesses does not exceed 0.040 in.

In welding pickled mild steel or standard steel, a speed of 180 satisfactory spot welds per minute can be attained on thicknesses up to 0.032 plus 0.032 in.

United States Rubber Company

A new one-man parachute boat, instantly inflatable, for emergency use on single-seater fighter planes has been developed by United States Rubber Company. The total weight of this boat, including the eleven items of equipment that help protect the flier, is only 12 lbs. It is attached to the pilot as a seat pack when he is in the plane, is held tightly to him in parachute descent, and can be inflated in from 5 to 10 sec. by turning a valve on a small CO_2 cylinder. First shipments of the new type boat are now being delivered. Advantages of the one-man parachute boat for speedy, small fighter planes are its light weight, great compactness and the fact that the boat always stays attached to the pilot.

Although this boat is 5 ft. 6 in. long by 3 ft. 4 in. wide when inflated, it folds into a compact seat pack only 14 by 15 by 4 in. Within this package is a full set of vital equipment. Two wire-reinforced fabric paddles fit the hands of the airman and operate as the web feet of a duck to propel and steer the boat. A concertina hand pump is fastened to the valve and can be used for maintaining required pressure.

In case the boat should be pierced with machine gun fire, the equipment includes special plugs which can quickly be fastened into the holes made by a bullet. If any accident should happen to the boat, equipment is available which can be used for emergency from either within the boat or from the water. It includes a collapsible fabric bailing cup and a collapsible fabric sea anchor. In addition, the Government furnishes a can of water and a sea marker for use in drawing attention for rescue purposes.

United Cinephone Corporation

Point-to-point communication by means of a receiver-transmitter, called the Model BRT, is being offered by this company's Airphone division. Operated by dry batteries, the equipment is claimed to be compact and lightweight and simple to install, operate and maintain.

A "Helldiver" Screams Down on the Target!

ITS WRIGHT CYCLONE ENGINE POWERED BY

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TAKE-OFF, power dive, pull-out . . . the throttle response of this deadly dive bomber must be instant . . . sure. For on its performance hang the lives of the crew.

That's why in this new Curtiss "Helldiver" (SB2C-1) with its Wright Cyclone engine, and in many of its other ships, Curtiss-Wright uses Shell Aviation Fuels. You'll find this same preference from coast to coast among many plane and engine manufacturers, aviation training schools, transport lines and airports . . . not alone for Shell Aviation Fuels but for AeroShell Oils as well. Investigate!

Model of the new Curtiss "Helldiver" (SB2C-1) Dive Bomber shown, courtesy of Curtiss-Wright Corp., New York, N. Y.

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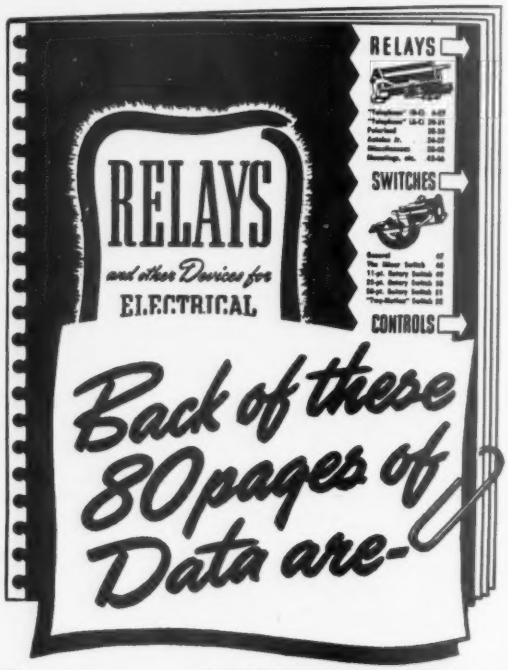

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And Automatic Electric's field engineers can provide practical assistance too—make valuable time-saving and effort-saving suggestions. Ask our nearest representative to work with you in selecting the equipment best adapted to your needs. A letter or call to our nearest office will bring full information promptly, or if you prefer, write us direct.

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The transmitter section has an output of 1/2 watt and a frequency range of from 2,000 to 8,500 kc. It is crystal controlled. The antenna requirements are flexible, with 1/4 wave-length aerial recommended for maximum range.

Also crystal controlled, the receiver section has a frequency range of from 2,000 to 8,500 kc. Its volume control and audio level control are both automatic. The output impedance to the earphones of the system is 500 ohms.

Westinghouse Electric & Manufacturing Company

New developments in wartime lighting, including the use of "glare barrages" to protect vital industrial plants, were described at a recent meeting of field engineers of the Westinghouse Electric & Manufacturing Company's lighting division. Among lighting innovations discussed was the use of horizontal glare barrages, which are intended to blind potential saboteurs during attempts to enter industrial properties yet at the same time provide visibility for plant policemen to detect intruders. Application of a new 3-kw. high-intensity mercury lamp for war production industries was also discussed at the conference.

How airports in combat areas may provide for operations in black-outs by "strip" lighting was described. Strip lighting, it was explained, means that a pilot takes off or lands between two strips of lights lining the runway, while the remainder of the airport is in darkness.

Localized lighting, direct and indirect glare, and shadows are eliminated in industrial plants by a new method of indirect mercury lighting designed by the Westinghouse lighting division.

Hitherto impractical for industrial use until the recent development of the 3,000-watt mercury vapor lamp, the system was worked out using a working model of an airplane plant. This plant will be the nation's first to adopt the new indirect lighting design to obtain high intensity, glareless and shadowless illumination.

A tunnel-shaped plant model represented part of the plant. The high-intensity mercury lighting was simulated by suspending two lines of high-voltage fluorescent tubing from the center of the vaulted arch ceiling. Walls, ceiling and floor of the model were made of 1/4 in. compo-board and were coated with several kinds of white paint to determine maximum surface reflectivity.

By obtaining reflection factors for the white ceiling and floor of 75 and 65 per cent, respectively, about 35 foot-candles of illumination is provided under the wings of model planes placed inside. Although much aircraft assembly work is done on the underside of wings and fuselage, localized lighting to provide the desired illumination is not necessary.

Whiting Corporation

A new engine assembly stand for holding large in-line aircraft engines in any desired position during assembly or overhaul is now being manufactured by the aviation division of Whiting Corporation, Harvey, Ill. Its important features are the rotating rings and horizontal tubular members to which the engine brackets are bolted. The engine is quickly and easily bolted into position and the entire unit is readily maneuverable in the production line or other congested places.

The framework rings and other members of the Whiting Model E3 assembly stand have been reduced to the minimum compatible with weight and size of the work to be done. Projecting parts have been eliminated, and the design is said to reduce the possibility of injury to workmen, making for full accessibility to the work at all times.

The aviation division has also introduced the Whiting Propeller Trailer, a specially designed unit that simplifies the handling and storing of all standard aircraft propellers. The unit is easily maneuverable. It simplifies changing, servicing, and storing propellers, affording full protection to the blades. The unit may be used in the hangar, on the field, or hitched to car or truck or other motorized equipment, singly or in train for cross-country movement of propellers. Tubular steel construction of this unit provides strength with a minimum of weight and superstructure. A two-way brake locks the front wheels and also stops swiveling.

Wilson Welder and Metals Company, Inc.

A new electrode designed specifically for all-position welding of mild steel with alternating current type welding machines has been developed by Wilson Welder and Metals Company, Inc., in diameters of 1/16, 3/32, 1/8, and 5/32 in. Made to fill a need for a high quality a.c. electrode for all-position use, the Wilson No. 530 electrode is said to comply with all requirements of the American Welding Society Classification E6011, American Bureau of Shipping, Group H1G and B1G for a.c., and other specifications qualifying it for use on war work.

Wright Aeronautical Corporation

A new process in cutting tools, intended to save strategically important supplies of tungsten, cobalt and molybdenum tool steel and which is applicable not only to aircraft engine building but to all other industries using lathe tools, has been developed by Wright Aeronautical Corporation.

Tests made over a period of many months, in which over 100,000 alloy steel forgings were machined, show that gains in tool life of as much as 2,000 per cent are possible on high-speed steel lathe tools by grinding and honing the cutting tools to a highly polished, mirrored finish and also by using a new form of tool to break up the chips and shavings.

Little high-grade tool steel is lost by actual cutting operations. The loss comes from the grinding necessary to sharpen the tools after they are dulled by use. With the new tool shape and polishing process, the number of pieces that it is possible to machine before regrinding has been increased from ten to twenty times.

Where machine tool operators formerly ground each tool by hand, specially devised fixtures now hold the cutting tools for automatic grinding in groups of 18. Additional fixtures hold the tools one at a time for a slight final grind on a very fine stone, followed by the ultrafine polishing operation.

As a result of these precision operations tool life has been extended. Where it was possible to cut 13 gears per grind with one type hand-ground tool, it is now possible to cut 200 to 500 of the same gears with machine-ground tools. Another type of tool formerly cut 30 shafts before resharpening. Precision-ground, it now cuts 200 to 300 shafts. Still another tool had to be reground after each cut on one of the larger parts of a Cyclone engine. Precision-ground, the same tool now machines 28 of the same forgings.

The new form of the tool quickly breaks the chips up into short, small pieces. There is no long contact between hot chip and cutting tool. Consequently, the tool cuts cooler. Furthermore, the small, rapidly broken chips offer less resistance to the flow of coolant oil over the cutting edge. Polishing the entire contact surfaces of the tool not only adds strength but reduces friction and thus decreases wear.

Full details of the new processing—types of stones, fixtures, the exact angles of cutting faces, the method of honing and finishing—are being released by the Wright Aeronautical Corporation for use by other manufacturers, thus affecting a nation-wide saving when applied to hundreds of thousands of lathe tools daily.

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Institute News

Eleventh Annual Meeting Sessions to Be Held at Three Localities

Notice of plans to hold the Eleventh Annual Meeting during the last week of January, 1943, has recently been sent to all members of the Institute. The Annual Business Meeting of Members will be held on Wednesday, January 27, in New York, but the Technical Sessions will be presented simultaneously in Los Angeles and Detroit, as well as in New York. This will be done in order to minimize the amount of travel necessary for members in various parts of the country to attend the meetings. Papers will be presented by proxy at the meetings that the authors may not be able to attend.

Technical Sessions are being planned for the following subjects: Aerodynamics, Airplane Design, Aircraft Production, Air Transport, Materials (ferrous, nonferrous, organic and synthetic), Meteorology, Power Plants, Radio and Instruments, Rotating Wing Aircraft, Physiologic Problems and Structures.

Exact dates of the various sessions in New York, Los Angeles and Detroit will be published later.

10th Anniversary Issue

The November, 1942, issue of the AERONAUTICAL ENGINEERING REVIEW will be a special issue to mark the tenth anniversary of the Institute.

Special features are planned for this issue, among them being a record of the engineering achievements of the important aircraft, air-line, engine and accessory companies over the past ten years. A list of Institute members will be included as well as a record of the growth and development of the Institute since its founding in 1932.

Student Branches

Academy of Aeronautics

The following new Branch officers have been elected: Chairman—Frederick T. Williams; Vice-Chairman—Frank J. Bundschuh; Treasurer—Earl A. Fickett; Recording Secretary—Malcolm Erisman, Jr.; Sergeant-at-Arms—Carl Giglio; Honorary Chairman—Walter M. Hartung; Faculty Adviser—Milton F. Edwards.

Two papers written by Student Members were presented at meetings in August. The first, "A Discussion of Past, Present, and Future Types of Flying Wings," was presented by Roy A. Wulff. The second, "Controllable Pitch Propellers for Light Airplanes," was by Norman Rice. The motion picture *Building the PBY Record Breakers* was also shown.

The Aeronautical University

The motion picture describing the Consolidated PBY's was shown to the entire school assembly on August 23 under the auspices of the Branch.

At a business meeting held on August 25 the following new officers were elected: Chairman—Don Lindquist; Vice-Chairman—Willard Abbe; Secretary-Treasurer—Leland Bonvallet. A vote of thanks was given to the retiring officers. Student Membership Emblems were distributed to recent members and a date was set and a committee on arrangements appointed for the induction of new members.

Boeing School of Aeronautics

Officers recently elected for the current school term are: Chairman—Richard Fayram; Vice-Chairman—John Sugden; Secretary-Treasurer—John Chikes. Since enrollment of civilian students has been discontinued, the Branch will suspend activities at the end of this term. All the facilities of the school will be devoted to special training courses for military personnel.

Casey Jones School of Aeronautics

The Branch held its semiannual dance on Saturday evening, August 29, at the Hotel Astor Roof, New York City. The dinner dance was attended by 40 couples, including members of the faculty. The other feature of the month's activities was the semiannual banquet of the graduating class. This was held on Thursday evening, September 3, at the Cadillac Restaurant in Newark and was attended by the entire membership of the Institute Branch. Short speeches followed the dinner.

University of Michigan

At recent meetings the motion picture *Keep 'Em Flying* and the slide film and lecture on the *Development of the De-Icer* were shown. The latter was followed by a talk by Mr. Albert Gail of the University Faculty in which he told of his research work on the effects of icing on aircraft performance.

The film *Cannons on Wings* was presented at an open meeting on August 11 to an audience of about 300. After the showing, Frank Thorpe, Treasurer of the Branch, gave a short talk on aircraft armament, using a World War I machine gun for demonstration.

Members of the Branch visited the Army Air Forces post at Selfridge Field on August 15 under the auspices of Colonel Colman, the Commanding Officer.

A. & M. College of Texas

The films *Victory in the Air* and *Cannons on Wings* were shown at a meeting on August 20. On September 3 the Branch held a joint meeting with the student chapters of the A.S.M.E. and the S.A.E. A talk on the registration of professional engineers was given by E. W. Pitman and the motion pictures *Keep 'Em Flying* and *Development of the De-Icer* were shown.

News of I.Ae.S. Members

R. C. Adler, formerly of The Glenn L. Martin Co., has become Chief Engineer of All American Aircraft Products, Inc., a California firm manufacturing a variety of sheet metal, metal tubing and plywood aircraft parts.

"On loan" to the office of the Quartermaster General of the Army since last May, **George P. Baker,** M.I.Ae.S., has resigned as Vice-Chairman and a Member of the Civil Aeronautics Board to devote full time to his duties as Chief of the Requirements Branch, Military Planning

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WHAT landing gear to put on such a big ship and where to put it were the problems handed to "U. S." engineers.

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Division, Office of the Quartermaster General. He was Associate Professor of Transportation at the Harvard Graduate School of Business Administration before his appointment as a Member of the C.A.B. in August, 1940.

E. L. Bass, A.F.I.Ae.S., recently fuels and lubricants specialist on the staff of the British Air Commission in Washington, has returned to England to take up other war duties. His place has been taken by **T. B. Rendel,** who for the past two years had held Mr. Bass's previous position as Chief Engineer of the Aviation Dept., Asiatic Petroleum Co. Ltd., in London. He is now in Washington as Principal Technical Officer in charge of fuel and oil developments for the British Air Commission.

Charles D. Brown has left the faculty of the University of Maine, where he was Assistant Professor in Applied Mechanics, to become Research and Development Engineer for the Communication Products Co. in New Jersey.

John F. Burke, M.I.Ae.S., has joined American Export Airlines as a Dispatcher. He was formerly a Meteorologist on the staff of Pan American Airways System.

H. M. Conway, Jr., recently a graduate student at Georgia School of Technology, is now Assistant Aeronautical Engineer in the Office of the Director of Research, N.A.C.A.

Daniel O. Dommasch, formerly an Engineer with Brewster Aeronautical Corp., has joined the Civil Aeronautics Administration at LaGuardia Field as an Assistant Aeronautical Engineer.

Capt. J. H. DuBuque, M.I.Ae.S., recently retired from the Air Service Command of the Army Air Forces, has been named Chief of the First Officer Training School established by Pennsylvania-Central Airlines as part of its greatly expanded personnel training program. Captain DuBuque was formerly Chicago Branch Manager for Aero Insurance Underwriters.

Robert H. Dufort, M.I.Ae.S., has left Goodyear Aircraft Corp., where he was Head of the Stress Dept., to return to Bell Aircraft Corp. as a Structures Engineer.

J. T. Farrah is now a Flight Analyst in the Flight Test Group of American Airlines. He had previously been with Norris & Elliott, Inc.

Albert Gail, M.I.Ae.S., has been appointed an Assistant Professor on the faculty of Illinois Institute of Technology. He was Assistant Professor of Aeronautics at the University of Minnesota last year.

Richard C. Gazley, F.I.Ae.S., recently with Fairchild Aircraft Division, Fairchild Engine & Airplane Corp., has been made Engineering Manager of Porterfield Aircraft Co. at its new plant in Arkansas.

Ray G. Goodall, has left Lockheed Aircraft Corp., where he was a Stress Analyst,

Col. H. R. Harris.

to take a commission as 1st Lieutenant in the Army Air Forces.

Western Airlines has appointed **T. E. Hale** a First Officer (Air Cargo Division). He was a Draftsman with Lockheed Aircraft Corp., following his graduation from Curtiss-Wright Technical Institute in 1940, until last Spring when he completed additional flight training and received his commercial pilot license.

Harold R. Harris, A.F.I.Ae.S., has resigned as Senior Vice-President of Pan American-Grace Airways to accept a Colonel's commission with assignment as Plans Officer on the staff of the Commanding General of the Air Transport Command, Army Air Forces. Colonel Harris conceived the original plan for and helped to found Panagra in 1928 when he was in Peru as manager of an aerial cotton-dusting organization. He had been Chief Operations Officer ever since and participated in the expansion of the air line from its original single route between two Peruvian cities to the present system serving eight countries from the Canal Zone to Buenos Aires and linking the Atlantic and Pacific coasts of South America.

Charles Marcus.

Fred A. Heddleson, formerly Laboratory Engineer with The Glenn L. Martin Co., is now Supervisor of the Quality Control Laboratory, Lima Works, Westinghouse Electric & Mfg. Co.

Benjamin J. Kaganov has been made Head of Structures & Development, Plant C, Goodyear Aircraft Corp. He had previously been an Associate Aeronautical Engineer attached to the office of the Inspector of Naval Aircraft, Long Island City, N.Y.

R. S. Komarnitsky, M.I.Ae.S., who had been Metallurgical Consultant and Project Engineer for Breeze Corporations since 1933, has recently been made Chief Metallurgical Engineer, Armor Plate Division, Standard Steel Spring Co. He began work in the metal construction of aircraft in 1925 as a Draftsman and Project Engineer with the Sikorsky Aeronautical Engineering Corp. and continued with the development of corrosion-resistant steel aircraft structures as Chief Engineer of New Standard Aircraft Corp. from 1927 to 1933. He developed the Breeze process for manufacturing light armor plate.

Valerien P. Kousnetzoff, formerly Chief Engineer, American Mignet Aircraft Corp., is now an Aeronautical Engineer and Group Leader in the Engineering Dept. of Waco Aircraft Co.

Fred S. Kramer, M.I.Ae.S., has left Spartan School of Aeronautics, where he was Engineering Instructor, to take a position as Flight Test Engineer with Consolidated Aircraft Corp.

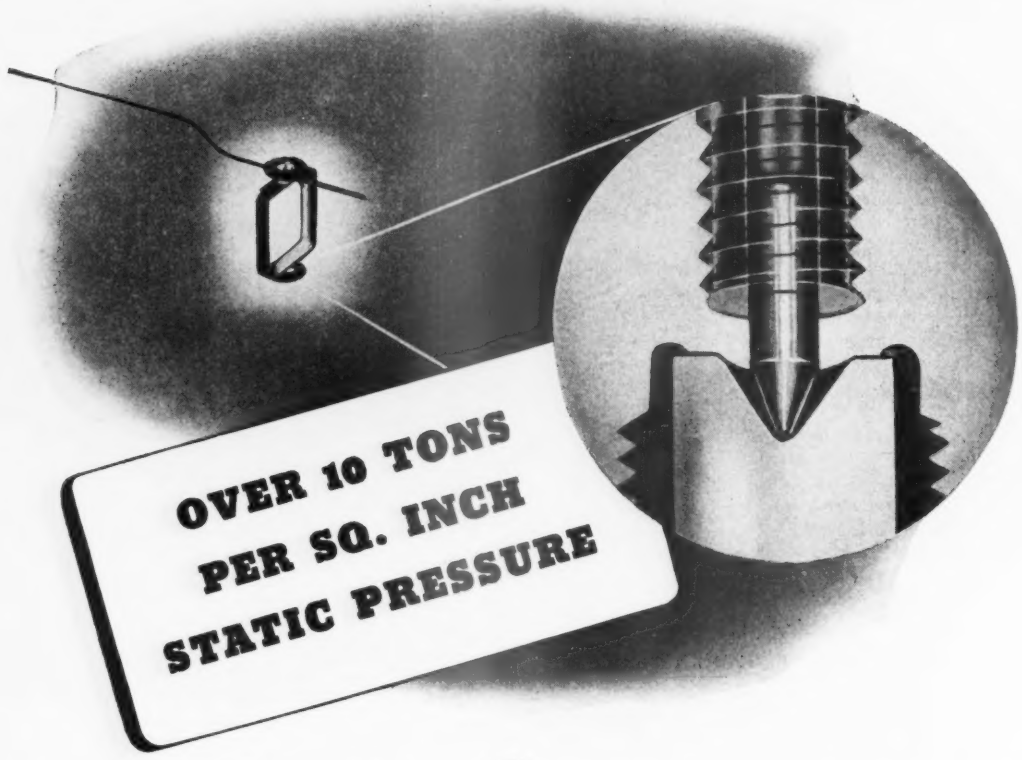
Herbert C. Langmore has joined the staff of Ford Motor Co. at the Willow Run Plant as a Wing Design Engineer. He had been a Liaison Engineer at Lockheed Aircraft Corp.

John W. Lawton, Liaison Engineer, Consolidated Aircraft Corp., is now located overseas with a U.S. Army Air Force Service Command assigned to aircraft engineering work in a Service Area Air Depot.

Charles F. Leiserson has resigned as an Aeronautical Engineer with Grumman Aircraft Engineering Corp. to go into training as an Aviation Cadet, U.S. Navy.

John C. Luttrell is on leave of absence from duties as Assistant Power Plant Project Engineer with American Airlines and is now an engineer with the Air Transportation Division, Air Transport Command of the Army Air Forces, in Washington.

E. R. Breech, M.I.Ae.S., President of Bendix Aviation Corp., has announced recent changes in duties of the executive staff of the company. **Charles Marcus,** M.I.Ae.S., formerly Vice-President acting as Group Executive over Eastern Divisions, has been made Vice-President in Charge of Engineering throughout the Corporation. He will also act as Chair-



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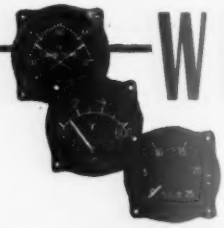

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man of the General Engineering Committee, recently created to coordinate the various engineering activities throughout all the Bendix divisions, and will direct the operations of the New Devices and Patent Group. **Raymond P. Lansing,** A.F.I.Ae.S., General Manager of Eclipse Aviation and Pioneer Instrument Division at Bendix, N.J., has been appointed Vice-President and Group Executive in charge of Eastern Divisions. **Arthur E. Raabe,** M.I.Ae.S., former Sales Manager of Eclipse Aviation, becomes Assistant General Manager of Eclipse-Pioneer.

Ensign Thomas D. Matteson, U.S.N.R., is now attached to the Power Plant Design Section, Engineering Branch, Materiel Division of the Navy Bureau of Aeronautics.

Frank S. Mayer has been transferred from Detail Draftsman to Junior Stress Analyst with Consolidated Aircraft Corp.

George M. Preston, Langley Memorial Aero. Lab., N.A.C.A., was recently promoted from Junior to Assistant Aeronautical Engineer.

Charles A. Sanford, Underwriter on the staff of Aero Insurance Underwriters since 1929, has been commissioned a 1st Lieutenant in the Army Air Forces and left for a training assignment at Miami early in September.

Roma L. Stephens, M.I.Ae.S., has resigned from the Civil Aeronautics Administration, for which he was Chief of Flight Engineering and Factory Inspection Branch, Fifth District, to become Chief of Flight Test Division, Goodyear Aircraft Corp.

Paul H. Stanley, A.F.I.Ae.S., Chief Aerodynamicist of G. & A. Aircraft, Inc., has been appointed a member of the Technical Committee for Individual Awards set up by the Office of War Information to honor workers in war plants who contribute valuable suggestions for increasing production.

Richard H. Thompson of Douglas Aircraft Co. has been promoted to Assistant Power Plant Engineer, El Segundo Plant.

In moves made last month to increase the effectiveness and striking power of U.S. Navy Air Forces, Chief of the Navy Bureau of Aeronautics **J. H. Towers,** M.I.Ae.S., was promoted from Rear Admiral to Vice Admiral and transferred to a newly created post as Commander, Air Force, Pacific Fleet, which was described by the Navy Department as "the most important air command afloat in the Navy." Admiral Towers will be in charge of and coordinate all naval air activities in the region. He will be subject only to orders from Admiral Chester W. Nimitz, Commander-in-Chief of the Pacific Fleet, to whom he will be, ex officio, principal adviser on aviation matters. In this duty

Vice Admiral J. H. Towers.

he relieves Vice Admiral William F. Halsey, Jr., who has led numerous task forces of ships and planes against Japanese bases and will henceforth be wholly employed as a task force commander.

Admiral Towers, who graduated from the U.S. Naval Academy in 1906, has been in the air arm of the Navy since 1911 when he received flying instruction from Glenn Curtiss and was one of the first three naval officers assigned to aviation duty. He was Assistant Director of Naval Aviation during our participation in World War I and in 1919 organized the unit of "NC" flying boats which made the first transatlantic flight. He commanded the U.S.S. "Langley," the U.S. Navy's first aircraft carrier; was Chief of Staff, Commander Aircraft Battle Force, from 1931–1933 stationed on the U.S.S. "Saratoga," which he later commanded; and was for a time Commanding Officer of the Naval Air Station at San Diego. He was Assistant Chief of the Bureau of Aeronautics from 1929 to 1931 and again in 1938, being appointed Chief in 1939.

Admiral Towers is succeeded as Chief of the Bureau of Aeronautics by Rear Admiral John S. McCain who has been in the aviation branch since 1935 and has commanded the Fleet Air Base at Coco Solo, the Naval Air Station, San Diego, the U.S.S. "Ranger" and the Aircraft Scouting Force. He recently returned from an air combat command with the Pacific Fleet.

Formerly Instructor in the Aeronautical Dept. of Rensselaer Polytechnic Institute, **Vincent C. Trimarchi** is now an Engineer in the Structures Section, Bureau of Aeronautics, Navy Department.

J. A. Wahle, who joined Pan American Airways System as an Apprentice Engineer, has been promoted to Project Engineer with Pan American Air Ferries, Inc.

Herbert K. Weiss, formerly Assistant Mechanical Engineer with the U.S. Coast Artillery Board at Fort Monroe, is now Mechanical Engineer, U.S. Antiaircraft Artillery Board at Camp Davis.

Shao Wen Yuan, recently Aeronautical Engineer, Vidal Research Corp., is now Research Engineer with The Glenn L. Martin Co.

Gill Robb Wilson, President of the National Aeronautic Association, has announced that future awards of the Collier Trophy will be made under a new policy by a committee including all previous recipients of the prize.

Personnel of the group to award the 1942 cup also will include representatives of the Aeronautical Chamber of Commerce, the Air Transport Association, the National Aeronautic Association and the Institute of the Aeronautical Sciences. Until this time, awards have been made by a committee appointed by the president of the N.A.A. according to no set formula.

The 1942 committee, most of whose members are also members of the Institute, is as follows:

Lt. Gen. H. H. Arnold, Commanding General, Army Air Forces; **Charles A. Lawrance,** President and Chief Engineer, Lawrance Engineering & Research Corp.; **Clarence M. Young,** former Secretary of Commerce; **William P. MacCracken,** former Assistant Secretary of Commerce; **Dr. George W. Lewis,** Director of Research, National Advisory Committee for Aeronautics; **Harold F. Pitcairn,** Pitcairn Autogiro Corporation; **Glenn L. Martin** President, The Glenn L. Martin Co.; **Frank W. Caldwell,** Director of Research, United Aircraft Corp.; **Col. Alvin F. Hegenberger,** developer of blind landing system and one of the world's outstanding navigators; **Donald W. Douglas,** President, Douglas Aircraft Corporation; **Juan T. Trippe,** President, Pan American Airways; **Lt. Col. Harry G. Armstrong,** U.S. Army Medical Corps; **Dr. Walter M. Boothby** and **Major R. W. Lovelace (M.C.),** of the Mayo Clinic; **Howard Hughes,** aviation financier and expert airman; **Col. John H. Jouett,** President, Aeronautical Chamber of Commerce; **Lester D. Gardner,** Executive Vice-President, Institute of the Aeronautical Sciences; **Col. Edgar S. Gorrell,** President, Air Transport Association; **William R. Enyart,** Vice-President, National Aeronautic Association; George Christopher, President of the Packard Motor Car Company; Dr. Sanford A. Moss, Engineer, General Electric Company; and William P. Redding, Executive Vice-President of the National Aeronautic Association, who has been requested to act as temporary chairman of the committee. The entire group will choose an executive committee to correlate the work of the far-scattered membership.

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This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

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AERONAUTICAL ENGINEERING REVIEW

Members Elected

The following applicants for membership or applicants for change of previous grade have been admitted to membership in the grades indicated since the publication of the list in the last issue of the REVIEW.

Transferred to Associate Fellow Grade

Pinkerton, Robert McLean, B.S.; Assoc. Prof., Aero. Engineering Dept., Agricultural & Mechanical College of Texas. (See W.W. in Aviation.)

Elected to MEMBER Grade

Cathaway, Russ George, B.S. in Ae.E.; Chief Structures Engineer, Fletcher Aviation Corp.

Chapel, Charles Edward, B.S. in Ae.E.; Educational Director, School of Motorless Flight for U.S. Army Air Forces, Twenty-nine Palms Air Academy. (See W.W. in A.)

Graham, Chedo Peter, B.S. in C.E.; Layout & Design Engineer, Airplane Div., Curtiss-Wright Corp.

Stiles, John Raymond, Tool Process Engineer, Goodyear Aircraft Corp.

Tifford, Arthur Norman, B.E.E.; Aerodynamicist, Airplane Div., Curtiss-Wright Corp.

Elected to Industrial Member Grade

Cheney, Joseph J., President & Treasurer, Spriesch Tool & Mfg. Co., Inc.

Harlow, Robert James, Manager, Customer Service Div., Lockheed Aircraft Corp.

Kemp, Alexander Nesbitt, President, American Airlines, Inc. (See W.W. in A.)

Munsey, Herbert Haskell, Patent Counsel, Bell Aircraft Corp.

Randall, Ira Sturgis, Asst. to Chairman of Board, Transcontinental & Western Air, Inc.

Elected to Technical Member Grade

Bowman, John Cowan, B.A. in E.; Aero. Supervisor, E.S.M.W.T., University of Texas.

Dalva, Edward, Production Engineer, Grumman Aircraft Engineering Corp.

Johnson, Harold William, B.S. in M.E.; Project Engineer, Airplane Parts Div., Briggs Mfg. Co.

Miner, Lindsey, B.S. in Ae.E.; Aerodynamics Computer, Lockheed Aircraft Corp.

Munroe, George Edwin, Chief Instructor, Training Div., Chamberlin Aircraft Corp.

Patrick, Lawrence Marion, B.S. in M.E.; Instructor, Aero. Engineering Dept., Wayne University.

Redwine, Dan Allen, B.S. in M.E.; Stress Analyst, Ft. Worth Div., Consolidated Aircraft Corp.

Spiegel, Herman Bert, Draftsman, Duncan Tool Designing Co.

Tegtmeyer, Ray C., M.S. in E.; Static Test Engineer, Airplane Div., Curtiss-Wright Corp.

Telesco, Lee Allan, A.B.; Aviation Cadet, U.S. Army Air Forces.

Wold, Robert Palmer, Ae.E.; Head, Materials Procurement & Engineering Dept., Airplane Div., Char-Gale Mfg. Co.

y Bouras, Jorge Perez, B.S. in Ae.E.; Exchange Student, Polytechnic Institute of Mexico City to Wayne Univ.; Instructor in Aero. Lab., Escuela Superior de Ingenieria Mecanica y Electrica, Mexico City.

Transferred from Student to Technical Member Grade

Allen, Edwin Clinton, B.S. in M.E.; 2nd Lt., U.S. Army Air Forces.

Altmaier, Robert David, M.S. in Ae.; Aero. Engineer, Airplane Div., Curtiss-Wright Corp.

Bennett, John Thomas, Engineer, Northrop Aircraft, Inc.

Blake, Ralph Leonard, B.Ae.E.; Engineer, Boeing Aircraft Co.

Blatz, William Joseph, B.Ae.E.; Jr. Engineer, McDonnell Aircraft Corp.

Clark, Robert John, B.S. in E.; Jr. Layout Engineer, Douglas Aircraft Co., Inc.

Craddock, James Richard, B.S. in Ae.E.; 2nd Lt., U.S. Army Air Forces.

Hoernschemeyer, Frank Harry, Jr., B.Ae.E.; Liaison Engineer, Aircraft Div., Briggs Mfg. Co.

de Aquino, Rinaldo Radler, M.S. in Ae.E.; Staff Engineer, Panair do Brasil, Brazil.

de Graffenried, Albert Lawrence, B. Ae.E.; Product Engineer, Sperry Gyroscope Co.

Donovan, Raymond Francis, B.Ae.E.; Lead-man, Vought-Sikorsky Aircraft Div., United Aircraft Corp.

Feldman, Robert Glen, B.Ae.E.; Jr. Design Engineer, Vought-Sikorsky Aircraft Div., United Aircraft Corp.

Friedman, Jack Henry, Ae.E.; Stress Engineer, American Central Mfg. Corp.

Jensen, E. William, Jr., B.Ae.E.; Engineer, Boeing Aircraft Co.

Kann, William Howard, Analyst, Boeing Aircraft Co.

Kelly, Patrick Ledoux, B.S. in Ae.E.; 2nd Lt., Asst. Station Tech. Inspector, U.S. Army Air Forces.

Kordenbrock, James Urban, 2nd Lt., U.S. Army Air Forces.

Lapinski, Lucian Stanley, B.M.E.; Engineer, Vought-Sikorsky Aircraft Div., United Aircraft Corp.

Lemont, Harold Edminston, Jr., B.S. in Ae.E.; Stress Analyst, Grumman Aircraft Engineering Corp.

Levin, Daniel Harris, M.Sc. in Ae.E.; Aero. Engineer, Consolidated Aircraft Corp.

Martin, Norman Justin, B.Ae.E.; Jr. Aero. Engineer, Ames Aero. Lab., N.A.C.A.

Maxwell, Robert Lewis, B.S. in Ae.E.; 2nd Lt., U.S. Army Air Forces.

McTigue, George Joseph, B.Ae.E.; Cadet, U.S. Army Air Forces.

Mendelsohn, Robert Abraham, Jr. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Mitchell, Donald Monroe, Instructing in Hydraulics & Civil Air Regulations, Spartan School of Aeronautics.

Norlander, William Anton, B.Ae.E.; Jr. Stress Engineer, Ford Motor Co.

Paulson, John Wilferd, B.Ae.E.; Jr. Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Savage, Charles Alfred, B.Ae.E.; Aerodynamicist, Consolidated Aircraft Corp.

Senior, John Lawson, Jr., B.S. in Ae.E.; Jr. Aerodynamicist, The Glenn L. Martin Co.

Skoog, Richard B., B.S. in Ae.E.; Jr. Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Spiegel, Joseph Morton, B.Ae.E.; Jr. Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Theiss, Edward Clement, B.Ae.E.; Jr. Aero. Engineer, Materiel Center, U.S. Army Air Forces.

Weiser, Howard Walter, B.S. in M.E.; Test Engineer, Wright Aeronautical Corp.

Personnel Opportunities

WANTED

Sales Manager. Must have considerable sales and aircraft experience. Please give qualifications, references and salary desired. Inquires will be held strictly confidential and should be made to the Office Manager, McDonnell Aircraft Corp., St. Louis.

Executive Assistant. Capable man with management experience to act as Assistant to the President. Inquiries will be held strictly confidential and should be made to the Office Manager, McDonnell Aircraft Corp., St. Louis.

Stress Analysts wanted by a large, well-known manufacturer of high-speed military aircraft, situated in Indiana. Only men with at least two years' experience who are not now employed in defense work or who can secure a release from their present employer need apply. Make application in writing, giving all particulars, and send to Box 170, Institute of the Aeronautical Sciences.

Metallurgist to take complete charge of Materials Laboratory with leading aircraft engine manufacturer. Must be familiar with modern heat-

INSTITUTE *of the* AERONAUTICAL SCIENCES
1932–1942

Since its incorporation in October, 1932, as a scientific membership society to advance the art and science of aeronautics, the Institute of the Aeronautical Sciences, in ten years of service to aviation, has become the representative technical society for the aviation industry and profession. It is the only organization in the United States which brings together all of the sciences and branches of engineering and technology which are applied to aeronautics.

Activities

In its tenth year, coincident with the great increase in aeronautical production and research in the nation's war effort, the Institute is expanding its membership and activities in keeping with the greater demands made upon its services. Beginning with aeronautical students, the Institute has increased the number and activities of Student Branches. Members of the Institute in aeronautical centers are organized in local Sections which hold their own meetings. More of these Sections are being formed this year and additional services provided for members. The Annual Meeting and other national meetings provide forums where specialists in all the aeronautical sciences may present and receive reports on progress made in their particular fields and learn of developments in other fields that have a bearing on their own work. All meetings are held with proper safeguards to prevent any unauthorized publicizing of important information. Several annual awards and honors are conferred by the Institute to recognize and encourage outstanding achievement in the aeronautical sciences.

Publications

Papers presented at meetings or submitted to the Editorial Board are published in the Institute's two monthly publications—the JOURNAL OF THE AERONAUTICAL SCIENCES and the AERONAUTICAL ENGINEERING REVIEW. The JOURNAL prints in each issue several full length scientific papers on new research and developments in various fields applied to aviation. The REVIEW keeps members and subscribers up to date on aeronautical news and literature through reviews of new books and periodical articles, government publications and trade literature and will publish more papers on applied engineering and aircraft production.

Research Facilities

Through the Aeronautical Archives of the Institute, members have for their use the most complete aeronautical library and reference research facilities maintained by any technical society. At Institute headquarters in New York, the W. A. M. Burden Reference Library of books, reports and periodicals, the Aeronautical Index of subject files, biographic files and bibliography, and the historical and art collections in the Archives are available for study. The Pacific Aeronautical Library at 6715 Hollywood Boulevard, Los Angeles, maintains a reference collection and reading room for members and loans books to company libraries in the area. Through The Paul Kollsman Library, aeronautical books are lent by mail without charge to members anywhere in the continental United States. In addition to a very complete collection of standard aeronautical reference works, the Kollsman Library has available for loan new aviation books as they are reviewed in the AERONAUTICAL ENGINEERING REVIEW.

Membership

In addition to membership in professional societies representing their particular fields, specialists applying their knowledge and experience to aeronautics find membership in the Institute of great value in the contacts made with others engaged in aeronautical work and in the broad coverage of all aeronautical problems furnished through its meetings and publications. All applications for membership are carefully reviewed by the Admissions Committee, which recommends the grade of membership for which the applicant is found eligible. There are advanced grades of membership—Associate Fellow, Fellow, Honorary Fellow—to which members may be elected as their experience warrants. Thus, a member receives due recognition—more valuable because it is given by his colleagues—for his contributions to the progress of aeronautics. New applicants may be elected initially by the Admissions Committee to the grade of MEMBER if they are engineering graduates with at least three years of experience or have had over five years' experience in research, engineering, or other special work applied to aviation; to the grade of Industrial Member if they have acquired a recognized standing in an administrative capacity in the aviation industry; to the grade of Technical Member if they are recent engineering school graduates or are engaged in technical aeronautical work. For those who are not qualified for any of these classes of membership but who wish to receive certain of the Institute's services and publications, the grade of Affiliate is provided. Student Members are admitted by application through Student Branches organized at their schools. Aeronautical companies, as well as individuals, are affiliated with, and participate in, the support of the Institute through Corporate Membership.

Dues

An entrance fee of $5.00 is required of all new members who apply for admission to a grade of membership to be specified by the Admissions Committee (Corporate Members, Student Members and those who apply specifically for the grade of Affiliate being excepted). Annual membership dues, covering a subscription to the JOURNAL OF THE AERONAUTICAL SCIENCES and the AERONAUTICAL ENGINEERING REVIEW, for the various grades of memberships are as follows: Fellows—$20; Associate Fellows—$15; MEMBERS—$12.50; Industrial Members—$12.50; Technical Members—$7.50; Affiliates—$5.00 (covering subscription to the REVIEW only; for the JOURNAL and REVIEW, dues in this grade are $12.50). Dues of foreign members in all grades except Affiliates are $10.

Those who are engaged in aeronautical work or who have an interest in any technical phase of aviation will find the services of the Institute to be a necessary aid in keeping abreast of developments in these times of such rapid progress. An application form and further information about membership can be obtained from an Institute member or by writing to the Secretary.

INSTITUTE OF THE AERONAUTICAL SCIENCES
1505 RCA BUILDING WEST
30 ROCKEFELLER PLAZA
NEW YORK

treat methods. Mid-west location. No application sought from persons employed in war production work except with approval of present employers. Address inquiries to Box 169, Institute of the Aeronautical Sciences.

Test Pilot wanted by leading aircraft engine manufacturer in East. Must be capable of operating 1,000 hp., single-engined airplane. Engineering background desirable but not necessarily required. No applications sought from persons employed in war work except with approval of present employers. Address inquiries to Box 168, Institute of the Aeronautical Sciences.

A Midwestern University has a vacancy on the regular teaching staff of the Department of Aeronautical Engineering. Applicants should have teaching, research, or industrial experience and be capable of teaching graduate, as well as undergraduate, courses in structures or aerodynamics. Rank and salary will be determined on the basis of applicant's qualifications. This would not be a "duration" appointment. Address inquiries to Box 167, Institute of the Aeronautical Sciences.

Instructor or Assistant Professor for Airplane Design, Stress Analysis and Modern Aircraft Structural Theory in order to fill existing vacancy in regular staff of Aeronautical Engineering Department at College Station. Must have degree in Aeronautical Engineering and practical experience in industry. Ample opportunity and encouragement are provided for research, as well as industrial contacts with the rapidly expanding aircraft industry in Texas. Rank and salary will depend upon qualifications. Applicants now employed in defense industry must obtain release by present employer before being accepted. Letter of application should include snapshot and photo together with personal data, educational background, and practical experience record in detail. Address replies to H. W. Barlow, Texas A. & M., College Station, Tex.

Stress man wanted to take charge modified Army and C.A.A. work for growing Ohio light plane manufacturer. Excellent working conditions. Permanent. Address inquiries to Box 162, Institute of the Aeronautical Sciences.

Airplane Designers, Stress Analysts and Draftsmen needed for few remaining vacancies on engineering staff. At least two or four years' experience essential. Write for appointment stating education, experience, and salary. Snead & Company, Aeronautical Division, 421 Canal Street, New York.

The Army Air Forces has urgent need for personnel with an aircraft engineering and maintenance background. The prime function of this personnel will be the coordinating of Army Air Forces contractor efforts in the Central States in supplying maintenance data, maintenance parts and maintenance tools as contracted. Approximately three-fourths of the time of this personnel will be spent in the field. Interested applicants should file qualification briefs with the District Supervisor, Central Procurement District, A.A.F. Materiel Center, 8505 West Warren Avenue, Detroit, Michigan, marked Attention: District Air Service Command Liaison Officer.

Aeronautical Engineer with experience in plywood aircraft manufacturing. State experience and salary expected in first letter. Address Aviation Engineering, Inc., 1390 Blashfield Street, S.E., Atlanta, Ga.

Draftsman, preferably with instrument experience, for work on confidential projects for Army and Navy having vital bearing on the War effort. Applicants must be able to satisfy F.B.I. regarding citizenship and loyalty prior to starting work. Residence and work will be in small town on Long Island. It is anticipated work will be permanent. Address inquiries to Box 157, Institute of the Aeronautical Sciences.

Engineering Instructors wanted by approved school in Midwest. Furnish qualifications, experience and snapshot in first letter. Address inquiries to Box 152, Institute of the Aeronautical Sciences.

Airplane Operations Analyst for work in connection with (1) the preliminary design of military and commercial cargo and passenger transport airplanes, and (2) the military operation of current-production cargo planes. Aeronautical engineering training and air-line operations training or experience are desirable. Persons applying for this position should be qualified to work independently on the analysis of transport air-line operation efficiency and operating cost. Address inquiries to Box 173, Institute of the Aeronautical Sciences.

AVAILABLE

Aeronautical Engineer and Commercial Pilot desires permanent position in test flying or similar work. B.Ae.E. degree with experience in design and test work. Over 1,000 hours flying time, primary, secondary, and cross-country flight instructor's ratings and C.A.A. ground instructor's ratings in engines and navigation. Currently employed as Chief Pilot of Government contract flight training school but would prefer work in which engineering training and experience could be utilized. Address inquiries to Box 172, Institute of the Aeronautical Sciences.

Graduate Mechanical Engineer and graduate student in Aeronautical Engineering, with three years' experience in Mechanical Design and Detail Drafting. Age 34. Desires position as aircraft draftsman with aircraft manufacturer. New York or New Jersey location preferred. Address inquiries to Box 171, Institute of the Aeronautical Sciences.

Aeronautical Engineer (B.S. in M.E., 1932), M.I.Ae.S., with approximately seven years' experience in aeronautical engineering, including responsible jobs as layout, structural design and stress analysis engineer, liaison work and aerodynamicist, seeks position as Chief Engineer or one of equal responsibility. Particularly qualified to handle complete design of aircraft, either plywood or metal, to C.A.A., Army Air Forces or Navy specifications and requirements. Also some experience as engineering representative to subcontractors. Inventive ability and production minded. Small or new companies soundly financed or established companies expanding into the aircraft industry are especially solicited. Address inquiries Box 166, Institute of the Aeronautical Sciences.

Aeronautical Engineer (Ae.E.), twenty-six years' experience in the design and construction of various types of military and commercial airplanes. Thoroughly familiar with Navy procedure. Interested in administrative or executive position only. Address inquiries to Box 165, Institute of the Aeronautical Sciences.

Aeronautical Engineer (M.S. in Ae.E.), presently engaged in research in a leading college, desires position with aeronautical concern. Welcomes appointment in the Near East. Willing to undergo special training prior to such appointment. Can speak languages of that region fluently. Address inquiries to Box 164, Institute of the Aeronautical Sciences.

Aeronautical Engineer (M.S.) desires position as project engineer or similar position with concern manufacturing light military or naval aircraft. Experienced in stress analysis, performance calculation, and has conducted research in stability and control characteristics. At present instructor in airplane design in engineering division of large flying school and flight student completing commercial pilot flight course. Familiar with requirements for civil and military primary training airplanes. Prefers project on trainer or light airplane involving difficult control problems at low speed. Age 25. Address inquiries to Box 159, Institute of the Aeronautical Sciences.

Aeronautical Engineering Review

Directory of

Aircraft Products and Services

The companies listed in this directory contribute to the support of the Institute of the Aeronautical Sciences, the Journal of the Aeronautical Sciences and the Aeronautical Engineering Review through Corporate Membership dues or advertising or both.

The Institute will appreciate any consideration that members and subscribers can give to the products or services of these companies. It will be glad to assist in obtaining complete information on listed or any other products or services not included.

ADHESIVES

United States Plywood Corporation
United States Rubber Company

AIRCRAFT

Airplane Division (Buffalo Plants), Curtiss-Wright Corporation
Airplane Division (St. Louis Plant), Curtiss-Wright Corporation
Bell Aircraft Corporation
Boeing Aircraft Company
Consolidated Aircraft Corporation
Douglas Aircraft Company
Duramold Aircraft Corporation
Engineering & Research Corporation
Fairchild Aircraft Division, Fairchild Engine & Airplane Corporation
Fleetwings, Inc.
Goodyear Aircraft Corporation
Grumman Aircraft Engineering Corporation
Intercontinent Aircraft Corporation
Lockheed Aircraft Corporation
The Glenn L. Martin Company
North American Aviation, Inc.
Northrop Aircraft, Inc.
Republic Aviation Corporation
Stinson Aircraft Division, Vultee Aircraft, Inc.
Vega Aircraft Corporation
Vought-Sikorsky Aircraft Division, United Aircraft Corporation
Vultee Aircraft, Inc.

AIR TRANSPORTATION

American Airlines, Inc.
Northwest Airlines, Inc.
Pan American Airways System
Transcontinental & Western Air, Inc.
United Air Lines Transport Corporation

ALTIMETERS

Kollsman Instrument Division, Square D Company
Pioneer Instrument Division, Bendix Aviation Corporation

ALUMINUM

Aluminum Company of America

BATTERIES

The B. F. Goodrich Company

BEARINGS

Allison Division, General Motors Corp.
Miniature Precision Bearings
Norma-Hoffmann Bearings Corporation

BOOKS (TECHNICAL)

Bunhill Publications, Ltd.
The Macmillan Company
The Ronald Press Company

BOMB RACKS

Spriesch Tool & Mfg. Company

CAMERAS & SUPPLIES

Fairchild Aviation Corporation

CARBURETORS

Bendix Products Division, Bendix Aviation Corporation
Chandler-Evans Corporation

CASTERS

Darnell Corporation, Ltd.

COLLECTOR RINGS

Edward G. Budd Manufacturing Company
Thompson Products, Inc.

COMPASSES

Bendix Radio Corporation
Fairchild Aviation Corporation
Kollsman Instrument Division, Square D Company
Pioneer Instrument Division, Bendix Aviation Corporation
Sperry Gyroscope Company
Weston Electrical Instrument Company

COMPOUNDS (CLEANING)

Oakite Products, Inc.

CONNECTORS (ELECTRICAL)

Cannon Electric Development Co.

CONTROLS & ASSEMBLIES

Automatic Electric Company
Breeze Corporations
Eclipse Aviation Division, Bendix Aviation Corporation
Guardian Electric Manufacturing Company
Pump Engineering Service Corporation
Spriesch Tool & Manufacturing Company
Sperry Gyroscope Company
Vega Aircraft Corporation

COOLERS (OIL)

Airesearch Manufacturing Company
Edward G. Budd Manufacturing Company
Fedders Manufacturing Company
Standard Aircraft Products, Inc.

CORD (SHOCK)

The B. F. Goodrich Company
United States Rubber Company

COWLS

Airplane Division (Buffalo Plants), Curtiss-Wright Corporation
Edward G. Budd Manufacturing Company
Vega Aircraft Corporation

DE-ICER EQUIPMENT

Eclipse Aviation Division, Bendix Aviation Corporation
The B. F. Goodrich Company
Pump Engineering Service Corporation

ELECTRICAL EQUIPMENT

Automatic Electric Company
Cannon Electric Development Co.
Ohmite Manufacturing Company
Shallcross Manufacturing Company
Square D Company, Regulator Division and Industrial Controller Division
Struthers Dunn, Inc.

ENGINES

Allison Division, General Motors Corp.
Eclipse Aviation Division, Bendix Aviation Corporation
Guiberson Diesel Engine Company
Jacobs Aircraft Engine Company
Packard Motor Car Company
Pratt & Whitney Aircraft Division, United Aircraft Corporation
Ranger Aircraft Engines Division, Fairchild Engine and Airplane Corporation
Warner Aircraft Corporation
Wright Aeronautical Corporation

FABRICS

Wellington Sears Company

FASTENERS

Boots Aircraft Nut Corporation
Camloc Fastener Company
Eaton Manufacturing Company
Elastic Stop Nut Corporation
Thompson Products, Inc.
Tinnerman Products, Inc.
United Carr Fastener Corporation

FELT

American Felt Company

FINANCIAL SERVICES

The Chase National Bank of the City of New York
The National City Bank of New York

FINISHES

Valentine & Company, Inc.